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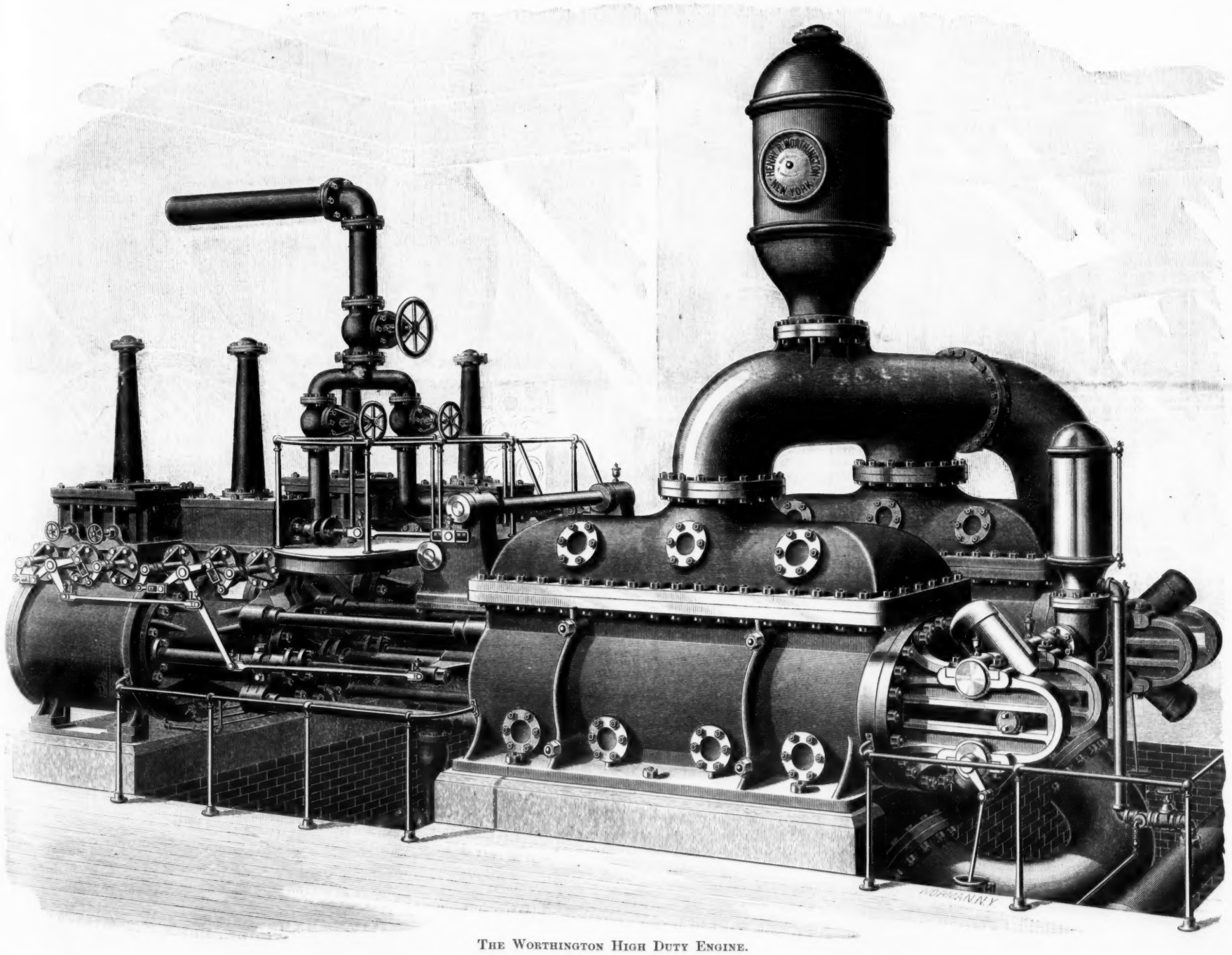
The Worthington High Duty Engine.

Many of our readers have doubtless heard of the high duty pumping engine, which the firm of Henry R. Worthington, of New York, have been for some time engaged in perfecting. We are enabled in this issue to present engravings of this engine, which with a brief description will show the principle upon which it is constructed.



THE WORTHINGTON HIGH DUTY ENGINE.

The extensive use of the Worthington duplex pumping engine for water works has made it so well known as to render detailed description of its general characteristics unnecessary. With this engine as formerly constructed, expansion by means of compounding was carried as far as it could be practically, but while remarkably good duty was obtained there was room for increased economy if a higher grade of expansion could be employed. The object of the inventions embodied in the present construction is to provide means for obtaining any degree of expansion up to the highest possible economic limit, and at the same time preserve all the approved features of the original construction.

The usual method of employing high grades of expansion is to use a heavy fly-wheel; in this case, of course, this could not be done without abandoning the distinguishing features of the engine. But by the plan that has been adopted, all difficulties have been removed, while every desirable feature of the engine has been retained.

The attachment by which this has been accomplished consists essentially of two small oscillating cylinders connected to an extension of the plunger rod of the engine, preferably, as shown in the engravings, pages 1 and 2, beyond the water end. These cylinders and their connections are filled with water or other liquid. Compressed air from a storage tank is admitted at a suitable pressure to maintain a constant load upon the pistons of these small cylinders, through the medium of the interposed water or other liquid. These pistons act in such a way (which will be readily understood from an inspection of the engravings), with respect to the motion of the engine, as to resist its advance at the commencement of the stroke, and assist it at the end; the air, meanwhile, exerting a practically unvarying pressure at all points in the stroke.

The two cylinders act in concert, and, being placed directly opposite each other, relieve the crosshead to which they are attached of any sliding frictional resistance, and the engine of any lateral strain. By thus alternately taking up and exerting power through the difference in the angle at which their force is applied with respect to the line of motion of the plunger-rod, these two cylinders, in effect, perform the functions of a fly-wheel, but with the important mechanical difference that they utilize the constant pressure of compressed air instead of the energy of momentum. Their action is readily controlled, and their power can not only be exactly proportioned to the work to be overcome, but is entirely unaffected by the speed of the engine. The same amount of expansion can be obtained in the same engine, whether running at a piston speed of ten feet per minute or at 150. This latter feature is one of great importance, affecting, as it does, so favorably the economy of the engine when applied on any service where the demand is irregular or intermittent. In such cases, the speed can be reduced or increased to suit the requirements, without the necessity of changing the point of cut-off.

The work of the compensating cylinders can, at the will of the attendant, be thrown on or off the engine instantaneously. Should they or the cut-off mechanism become in any way disarranged, or require overhauling or repairs, they can be quickly disconnected from the engine, which can then be run as economically and satisfactorily as though originally constructed without them.

When the air pressure in the tank is once established it does not diminish, except only to the limited amount due to the absorption of the air by the liquid in the cylinders; this is found to be hardly appreciable. Attached to the engine, and driven by it, is a small air compressor which fills the tank and serves to replenish it.

Where the most economic results are desired the expanding as well as the high-pressure cylinders on the engine are provided with cut-off valves. These consist of semi-rotating plug-valves placed in the admission ports of the cylinders, and operated by means of the direct connections illustrated in the engravings. As will be seen, their action is secured without the use of any eccentrics, gears, or cams. When the point of cut-off has been once fixed, it need never be altered.

Several important improvements in the general construction of these engines, some of which are not shown in the engraving on our first page, have been made. One of them, which may be seen in the sectional cut on page 2, is an arrangement for packing the rod, and the substitution of a single rod for the two rods formerly used to connect the pistons. With the single rod the friction of the stuffing-boxes is done away with. As will be seen, the rod is encircled by a long sleeve, made to accurately fit it. The ends of this sleeve enter packing recesses of usual construction; but fitting loosely in these recesses, the rod is free to move in any direction to compensate for lack of alignment from wear, or any other cause. The glands or followers fit this sleeve, and the latter, instead of the rod, is packed. By this means it is plain that, however hard the packing may be screwed up, no friction is brought upon the rod, which moves substantially frictionless through the sleeve.

Another improvement consists in taking the valve motion from the crosshead of the small compensation cylinders, instead of from the crosshead between the steam cylinders, as represented in the engraving on page 1. By this construction, should an accident happen, such as the breaking of a piston-rod, the engines will be brought to an immediate stop; the load of the plunger is interposed between the steam cylinders and the necessary motion to move the valves, and, of course, the compensating cylinders alone cannot overcome this load.

Tests of an engine of this type developing only 100 horse-power are said to have shown a duty of considerably over 100,000,000 foot-pounds per 100 lbs. of coal, with boilers having an evaporative efficiency of ten to one.

As showing the enormous effect of the compensating cylinders in equalizing the work, it may be mentioned that in one of these engines at present under construction for pipe line work, the cylinders being 41″ and 82″ diameter, respectively, it is calculated that at the slow speed found necessary for such work, viz., a piston speed of 65 feet per minute, the high duty attachment, weighing 3,500 pounds, will develop energy equal to that of a fly-wheel 40 feet in diameter and weighing 400,000 pounds.

The high duty attachment is not only applicable to new engines, but may be applied to any Worthington engine previously made. It is said that during the necessary alterations the engine need not be out of use more than one day, no alteration of other parts or surroundings being, as a rule, required. The change it is estimated, would result in increasing the duty by not less than 60 per cent., representing a saving in fuel equal to about 37 per cent.

The simplicity of the means employed, together with the remarkable results obtained, will call unusual attention to these engines.

Screw Cutting Dies.

By John J. Grant.

There is probably no one tool in the shop about which the average machinist (and I might include a fair sprinkling of tool-makers) knows so little as *screw cutting dies*, be they either for hand or power use.

Every year sees this branch of the tool business concentrated in the hands of those who make a specialty of taps and dies.

But as there are, and always will be, odd sizes and shapes of threads, as well as repairs to make, which can be done in the shop cheaper than by sending to the makers of such tools, it is necessary to know how to do this branch of tool making and do it well. Poor dies are a nuisance, and an incentive to profanity, as anyone knows who has had a tussle with them.

Dies are known as the jam plate, the solid, and the open dies respectively.

Jam dies are going out of use for regular work, even in small job shops, the new solid dies taking their place; they are, however, useful to dress over an old thread without reducing the size, and will always find a place in the shop equipment. The solid die is better adapted for new work, either in a small or a large shop. The modern die stock is fitted with this style of die, as well as some bolt cutters.

This die has an advantage over any other, even the open die, as it is always ready to cut a bolt to size without the adjusting necessary in that style. The open die is the correct thing to use for manufacturing bolts in large quantities, instant release after the bolt is cut allowing it to be withdrawn quickly or without reversing the machine and running back over the thread. Each and all of them have their place, and it is well to know how to make all kinds properly. What are called solid dies are not necessarily made from a solid block, but may have inserted cutters held rigidly in place, the block or head being made of cast or wrought-iron.

One of the greatest drawbacks to the use of the screw cutting die for accurate work, such as the leading screw for screw cutting engine lathes and other fine work, is the impossibility of cutting a perfectly pitched screw. Various arrangements have been tried to overcome this difficulty, but with only partial success.

The pitch of a screw cut with a die is in nearly every case finer, or has a greater number of threads per inch than the die is calculated to cut, not greater than the actual pitch of the die or fewer threads as is generally supposed. There are, however, cases where the thread is coarser than the die is calculated to cut; this is an exception and not the rule. The causes of variation in pitch are so numerous and of so many combinations that it is difficult to describe them in a short article. Among them may be mentioned, cutting the dies with imperfect hobs; chasers or cutters fitting badly in their seats; expansion or contraction in hardening; too much or too little clearance on the cutting portion of the chasers, and when all these troubles (as is frequently the case) are combined in one set of dies, the result is plain. There are workmen who will insist that the variation in pitch is caused by the stretching of the stock during the operation of cutting. This is erroneous, with the exception of the old-fashioned jam plate, and with that in such a small degree that it would be imperceptible in measuring with a common steel scale. I have tested this matter thoroughly by cutting the stock in lengths and fitting them to a 12″ vernier caliper; on measuring them, after being cut and cooled to the same temperature as they were on the previous measurement, I found them of exactly the same length as they were before the thread was cut; this was invariably the case, and anyone that is skeptical can try it for himself at a trifling expense.

In making dies, having inserted cutters, care should be taken to have all of the chasers or cutters of even length; they should also fit the slots or seats properly. In either solid or open dies a hob should be used having the front end for a length of from $\frac{1}{2}$″ to 1″ more than the threaded portion left plain and of a diameter slightly less than the bottom of the thread.

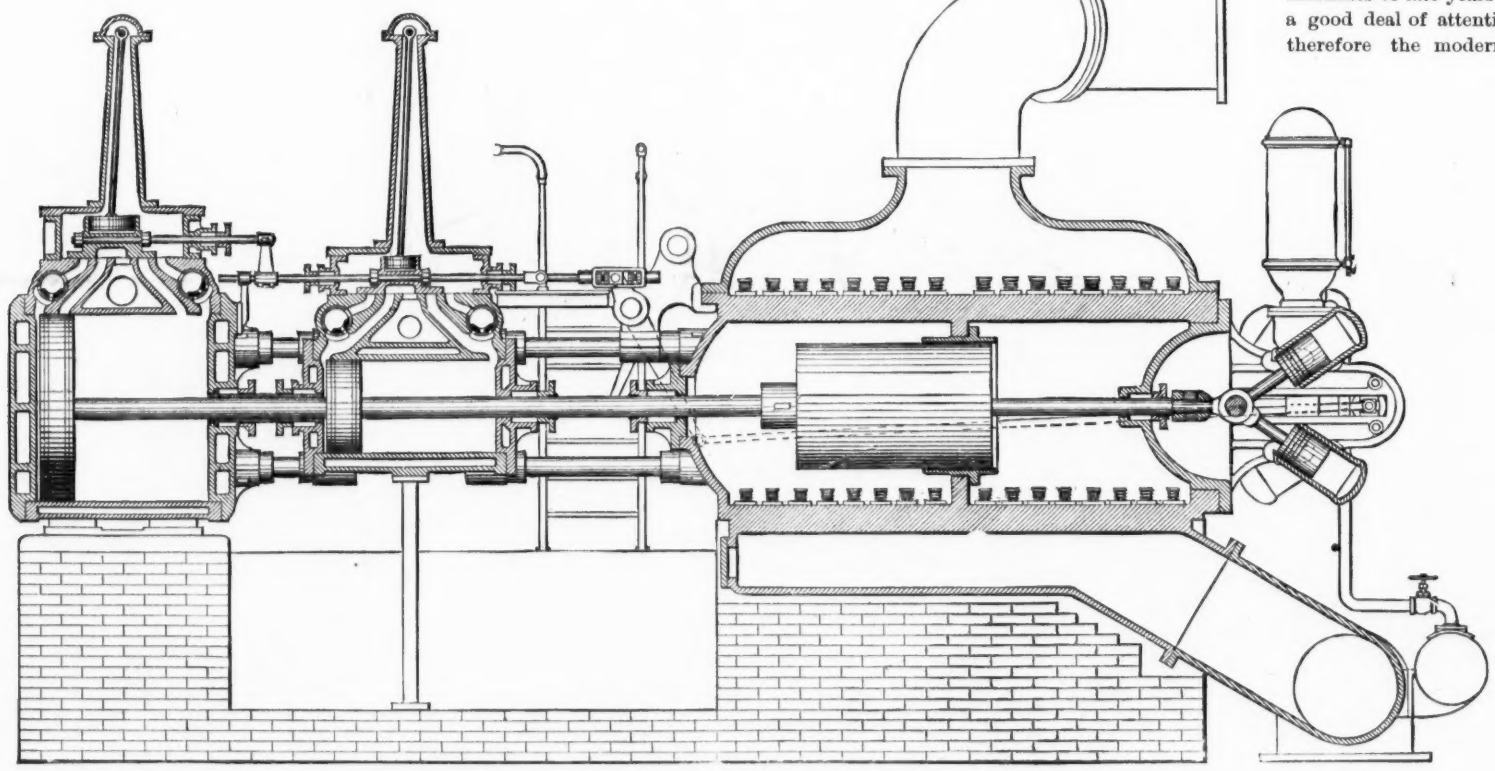
A bushing fitting this end is placed either in the spindle, if a revolving die-head, or at the rear of the die-head, if it is a stationary one; the object of this is to insure a perfect running die in the revolving die-head, and one that is in a perfect line with the spindle in a stationary head. Hobs of perfect pitch should be used; these can be bought of the makers of such tools better than they can possibly be made in the shop, for the reason that thousands of dollars have been spent to perfect the leading screws of the tap threading machines, and the pitch is more likely to be correct than when made in the average shop, as nine screw cutting lathes out of ten have imperfect leading screws.

Don't crowd the hob too hard; it is better to go over the die often, and finish with one or two very fine chips. To obtain absolute accuracy in angle of thread a hob should be used exactly the size of taps used to cut the nuts to be used on the bolts, or, in other words, if the die be for 1″ bolt use a hob exactly 1″ diameter, but with such hobs there can be no clearance on the dies except the slight clearance due to the springing of the chasers away from the cut. To obtain clearance a hob either smaller or larger than the size of bolt may be used; in one case it is necessary to cut away the back of the chaser to the center line, and in the other the front of chasers must be cut away. The hob should not be over $\frac{1}{32}$″ small on 1″ sizes and may vary proportionally in other diameters.

The next operation is making the cutting portion. This is where more fail in making a good die than in any other point. The bolt cutting machines of late years have received a good deal of attention and study, therefore the modern machine is presumably rightly constructed in the matter of sizes of stock for dies. A chaser to cut a 1″ bolt should not measure less than 1″ through, and should not have *less than four full threads*, as these act as leaders and determine in a great measure the accuracy of the pitch. The cutting portion should be reamed with a taper reamer; this may be done either before or after hobbing, and in no case in a new die should it be larger on the front than the diameter of the bolt. The extreme front may be filed a very short bevel or rounded at the end. This will remove any irregularity in the size of iron.

Too long a cutting surface and too short a leader on the die will be sure to cut a screw of too fine a pitch, because the dies having to draw the bolt into themselves, and also the vise or carriage, the front of the thread is being pared or re-cut by the sides of the chasers.

This and the shrinkage of hob and chasers is the general cause of shortness of pitch. The clearance on the cutting portion of the chasers should be very slight; if it be too rank it will cause the bolt to chatter on entering, and is more apt to break off at the extreme cutting point.



Section of Worthington High Duty Engine. See Page 1.

There must be judgment used in this part of the die making, and if they are to be used on any particular kind of stock, by altering the shape and watching the effect the best form of cutting edge for the different kinds of stocks may be obtained. In every case that has come under my notice where the pitch of the screw is coarser than is wanted or expected, the cause is found to be one of two things; either the dies or chasers have expanded in hardening or cracked between the teeth.

It is not necessary for each of the four chasers to expand, as one will be sufficient, the other three following in the wake.

I have in my mind a case of a party who was troubled by the threads being coarser $\frac{1}{16}''$ in about 18"; as this is only about three and half thousandths in one inch, it is very easy to see that two or three fire cracks between the teeth in connection with a slight expansion would be sufficient to cause that amount of variation; the probability is that the dies were of a very good form to cut the thread without paring, and, therefore, cut a thread the same pitch as the dies measured. I have talked with several men who use dies extensively in bolt cutting, and wherever I found a man who had looked into the matter he was of the same opinion as myself; I should, however, like to hear from other men having experience in this line, and get their views on the subject.

The manufacturer who hopes to hold his own in the fierce competition which characterizes modern industry, must of necessity keep a sharp lookout for valuable improvements in machinery, and must introduce them promptly when they are presented. The movement of the industries is always forward. Thousands of ingenious minds are continually studying out methods for making processes easier and more economical. Every month some kind of a device for bettering the way of doing a thing, or for saving a little labor, is patented. The manufacturer who simply ignores these things and runs along heedlessly in the old way, with the old devices, will be left behind and beaten as surely as the earth rolls around the sun. A mill built and filled with machinery twenty years ago, and left unimproved, could not begin to compete with a modern mill containing all the new mechanical improvements. And the way to keep a mill property from deteriorating is to add in every important improvement as soon as it is put upon the market. The most successful mills, without a single exception, are the mills that do this very thing; and they succeed because they do it.—*Textile Record.*

An Equalizing Dog.

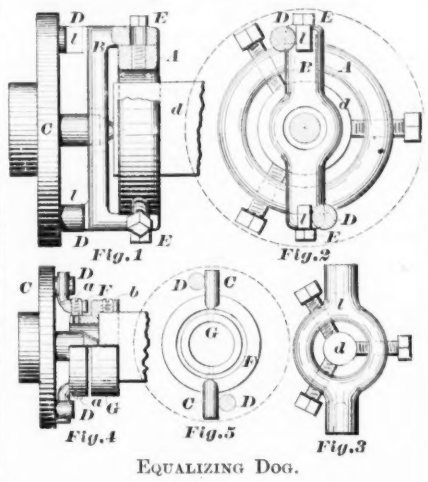
BY A. B. LANDIS.

I send you herewith drawings of an equalizing dog, which is simple and easy to make. The advantage of an equalizing dog, or equalizing carrier-plate (as is frequently used), is no doubt well known, and is the avoiding of side thrusts on the center, through carrying the work, which causes the work to run out of truth. In all cases, this feature is desirable, and especially so on a grinding machine; in fact, it is important. The dog illustrated will bear out its name.

In the drawing, Fig. 1 represents the dog in use; Fig. 2, an end view of the same. The ring *A* has three set-screws, two of which are used to adjust the ring nearly central with the work for a certain size, and one to fasten to the work so that only one screw is operated to use the dog on a certain size of shaft when a number are done at one time. *D* is an equalizing bar, which pivots on ring *A*, with screw *E E*, with lugs *e e*, which bear against pins *D D* of the face-plate *C*. A hole in the center of this bar allows the center to pass through to the center of the shaft *d*, with sufficient room to allow a vibrating movement of the bar *B*. Its action, no doubt, is clear.

Fig. 3 is a smaller ring with bosses to go into same equalizing bar, which takes for its largest size shaft the smallest held by the large ring, therefore giving a range from a large to a quite small shaft. The equalizing bar can be made, if preferable, with a large hole through it, so as to allow the shaft to pass through it instead of the center, with sufficient room for vibrating, in which case it would be a ring with the pivot lugs on one side, and the lugs *e e* on the other. The advantage in this would be that not so long a center is necessary as in the one shown.

Figs. 4 and 5 represent another form of the dog, which I made for special work on a



EQUALIZING DOG.

grinding machine where the work is turned to a size, and where the projections, as in the former dog, are somewhat objectionable. This does away with the projections and makes a neat job. *G* is a collar, which is recessed to fit the work. Two screws, like *b*, hold it to the work. A ring *F*, has arms *C C* set on to one side of it, which engage with pins *D D*. Two screws *a a* form the pivot for this ring, by which it will be seen it can readily equalize.

A number of collars like *G* can be made for different sizes of special work (which is the way I use it), therefore only requiring one ring *F* and its screw *a a*, by which it can be readily changed from one to the other. With a hope that it may be of benefit to some readers, I cheerfully contribute it to your columns for their benefit.

The left-handed man is one of the shop treasures. The value of a left-handed man lies in the fact that he can work to advantage in many places where a right-handed man would be at fault, and a good natured left-handed man is always sure of being profitably employed upon any job.

A New York firm has set aside a certain percentage of their earnings, which will be divided among their employes according to the amount of pay received during the year, virtually making each employe a partner.

Halladay's Automatic Band-Saw Sharpener.

With the general use into which the band-saw has come, methods of accurately sharpening the teeth are important. The engraving represents in one of the sizes a machine for this purpose.

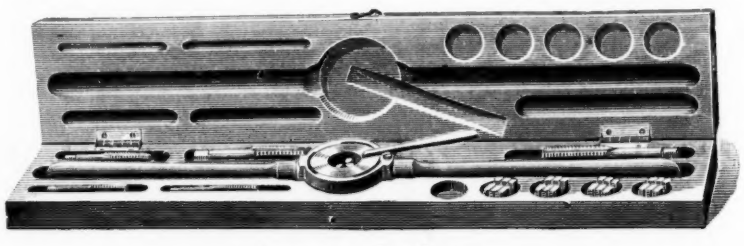
The saw to be sharpened is carried on two horizontally-placed pulleys, only one of which is shown. These pulleys are readily adjustable for different lengths of saws. The driving shaft, at the back of the machine, connects by a belt to the arbor on which the emery wheel is mounted. The driving shaft also carries a worm wheel, which operates the feed shaft. Upon the feed shaft is an eccentric; on this eccentric the lever rests which raises and lowers the emery wheel as the teeth of the saw are moved into place for sharpening.

The feed finger is attached to a perpendicular lever; this lever is pivoted at its lower end, and receives motion from a crank on the end of the feed shaft. The connection between the crank and lever is by means of a block in a groove in the lever. Any required adjustment for pitch of teeth can be made. Any variation in the "hook" of teeth can also be made.

The saw is stationary during half the revolution of the feed shaft, and during that time the wheel grinds the face of a tooth. While the saw is being moved forward, the emery wheel slowly rises, grinding the back of the next tooth. The frame-work which carries the saw is adjustable to various widths of saws by means of the hand-wheel and screw seen at the right front corner of the frame. The gearing of the machine is such that, with the driving shaft running at 1,200 revolutions a minute, the emery wheel makes 3,300 revolutions a minute and feeds 100 teeth per minute, the average capacity of the machine.

These machines are designed for sharpening fine as well as coarse saws. We are informed that emery wheels only $\frac{3}{4}$ in thickness may be used.

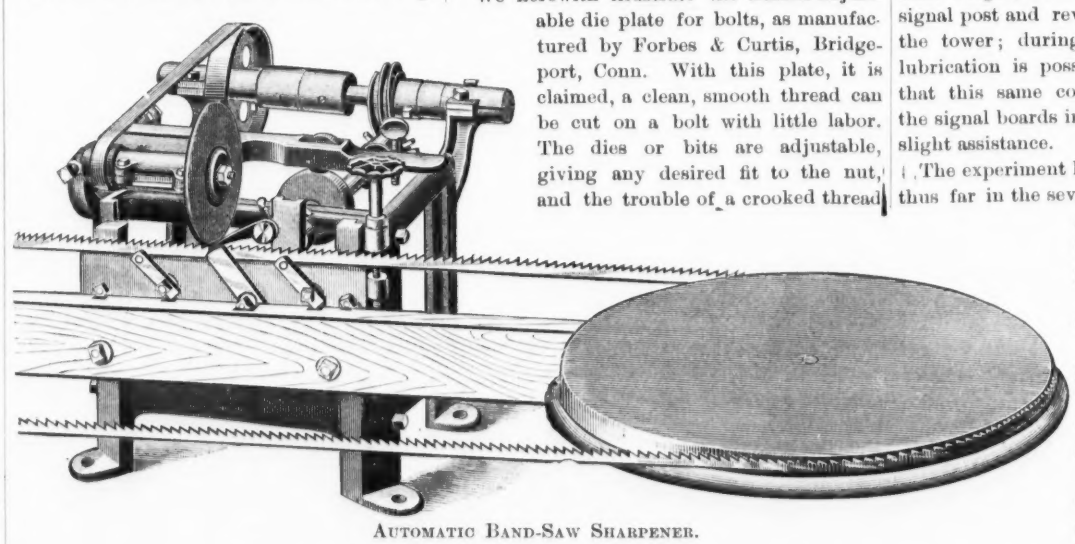
The N. Y. Supply Company, 50 John St., New York, are agents for their sale.



ADJUSTABLE DIE PLATE.

Adjustable Die Plate for Bolts.

We herewith illustrate the Barnes adjustable die plate for bolts, as manufactured by Forbes & Curtis, Bridgeport, Conn. With this plate, it is claimed, a clean, smooth thread can be cut on a bolt with little labor. The dies or bits are adjustable, giving any desired fit to the nut, and the trouble of a crooked thread is avoided by a simple self-centering adjustable guide, which can be removed in a moment, if the thread is to run close up to the head of a bolt. This guide is adjustable by simply turning it until the steel dogs close on the rod, and it there remains without any screwing up of set screws or tightening of any kind. The bits are all interchangeable, and can be sharpened by grinding on their face. The entire outfit—taps and dies—is put up in a box, which is well finished and convenient.



AUTOMATIC BAND-SAW SHARPENER.

A Practical Test to Operate a Distant Signal by a Wire Run Through a Pipe Filled with Oil.

A PAPER READ BEFORE THE ENGINEERS' CLUB, OF PHILADELPHIA.

BY WM. H. DECHANT.

During last September a distant signal was required to protect a new crossing over the Little Schuylkill branch of the Philadelphia and Reading Railroad, between East Mahanoy Junction and Tamanend. The distance from the operating office to the semaphore signal post is 1,100 feet, and is part way along a 4 and a 6 degree curve.

Instead of leading the wire through a long wooden box, supported on small pulleys, as is usually done, above the surface of the ground, it was decided to try the experiment of running the wire through a pipe filled with oil, buried below the surface of the ground. A trench, averaging 15 inches in depth, was dug along a carefully laid-out line; stakes 8 feet apart were driven along the bottom of this trench, so that their tops should come to a uniform grade line, which in this case was about 66 feet per mile; upon the tops of these stakes the $\frac{3}{4}$-inch galvanized iron pipe was fastened, so as to hold it in as true a position as possible.

A No. 15 iron wire was strung through each piece of pipe as they were screwed together, so that it might be used to draw the signal wire through the pipe line after it was all laid. The pipes were all carefully examined and cleaned; a number had to be rejected on account of lumps of iron or galvanizing material obstructing the bore of the pipe. After the pipe was laid, the $\frac{3}{16}$-inch iron signal wire was stretched out with block and tackle to straighten it and take out all short kinks, and was then pulled through into its proper position in the pipe, by the smaller wire that had been strung through during the laying of the pipe; a small brass stuffing-box was screwed to each end of the pipe, through which the ends of the leading wire were passed; these stuffing-boxes prevent the escape of the oil. The ends of the pipe being thus closed up, it was filled with common car lubricating oil, mixed with about one-quarter part of refined coal oil to keep it from thickening in cold weather; the filling was done through a short upright branch pipe attached at the highest end of the pipe.

The lever, by which the distant signal is operated at the signal office, by the same movement turns four signal boards on the tower, and during the summer the usual counterbalance on the semaphore signal post, adjusted to exert its least weight, would operate the arm on the signal post and revolve the signal boards on the tower; during the colder weather the lubrication is possibly slightly stiffened, so that this same counterbalance barely turns the signal boards in the tower and must have slight assistance.

The experiment has proved very successful thus far in the severe weather of this winter, and has required no attention since being placed in position.

The apparent advantages of this plan are:

1. A very permanent and lasting arrangement.

2. Freedom from disturbance or accident to the signal wire.

3. Entire freedom from the difficulties caused by expansion, if the pipe is laid below the frost line, and subject to but slight changes caused by change of temperature if laid only one foot under ground.

4. Obviating the necessity to provide angle fixtures to change the direction of the wire around curves.

The difference in cost of materials per 100 feet is but a trifle, being $5.38 for the pipe plan and $5.42 for the wooden box plan. The difference in labor would depend upon the character of the ground, but in most cases it would be nearly the same.

Learning to Draw.

BY JAMES F. HOBART.

THIRD PAPER.

In the text book before alluded to, and which we call the "instructor" of our home drawing school—we find a number of problems which are of great importance to the student.

We must become familiar with bisecting lines and angles, erecting perpendiculars, constructing figures, having given points or lines; and, above all, with the methods of erecting perpendiculars from or to given points or lines.

Two methods of erecting a perpendicular are worthy of special notice, and they will be found of value in every-day shop practice, as well as for use on the drafting board.

We cannot find space to refer to all the problems that will arise; they can be found in any good work on geometry. Erecting perpendiculars, however, will be made an exception for the purpose of illustrating its application in running lines of shafting and other work in mill or shop.

In the engraving, erecting perpendiculars *b c* is a line from which we wish to erect a perpendicular at *a*. In shop idiom the word square is used for perpendicular, therefore, if we say draw a line from *a* toward *d*, and have this line square with line *b c*, we shall have said the same as to say at *a*, erect a line perpendicular to *b c*.

Open the compasses to any convenient distance and make the arcs *b* and *c*, which will be at the same distance from point *a*. Now open the compasses a little more and make marks at *d*. Now if a line be drawn from *a* to *d* it will be the perpendicular sought. The chance of error will be lessened if other arcs are made at *i*, and the rule laid on *d* and *i* when drawing *a d*.

When a line is desired from *g* to *e f*, it is only necessary to set one leg of the compasses at *g*, describe the arc *e z f* with the other leg; then with *e* and *f* as centers, locate the point *h*. If the line *g l* be produced it will be perpendicular to *e f*.

Sometimes the perpendicular must be erected near or at the end of the given line. In this case we take *q* for a center and draw the arc *r s t*. Now, with the same radius, lay off *r s* with *r* as a center; with *t* and *s* as centers cut the arcs at *u*, which point is perpendicular to line *q r*, and *q u* may be produced through these points.

As a practical example of the value of this method in the mill we will illustrate its application in a certain case from individual practice.

The main shaft in a certain mill was driven by two water wheels by means of bevel gears. A steam engine supplemented the wheels during low water, when one water wheel gear would be driven back, and the engine attached by driving into mesh, a gear on the engine shaft.

By some mistake the engine shaft was placed "out of square" about 1½ inches in 10 feet, and could not be moved. It caused the connecting gears to wear very much, and arrangements were made to place a universal joint in the shaft from the engine.

Measurements were made; the shafts cut to length; the universal coupling fitted in the shop, and every preparation made to ensure a fit all round.

Upon arriving at the wheel pit the position of the shafting was much like *j k* and *o x*. There was no means of locating the point *p* except by the use of a few brains.

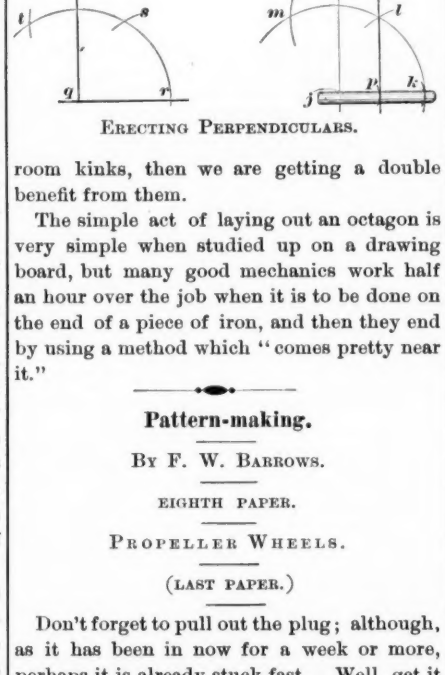
A trammel was improvised by driving two awls through a lath. The center of shaft *j* and *k* was located on the under side of the floor overhead by means of the plumb line. Shaft *o x* was located in the same way, then the perpendicular *n j* was erected by the method described, using the lath and awls in the place of compasses.

The distance *n o* was laid off at *j p*, and the line *o p* produced and marked on the ceiling, to be used as a permanent guide in completeing the job.

The value of these little problems in geometrical drawing is apparent from this example, and after once becoming acquainted with them they prove so useful in the shop that we should not know how to dispense with their use.

The second method given above might have been used in this case by prolonging the line *j k*, and then using point *o* as we did point *g*.

It matters not when a point is gained, and if we can help our shop practice by drawing



ERECTING PERPENDICULARS.

room kinks, then we are getting a double benefit from them.

The simple act of laying out an octagon is very simple when studied up on a drawing board, but many good mechanics work half an hour over the job when it is to be done on the end of a piece of iron, and then they end by using a method which "comes pretty near it."

Pattern-making.

BY F. W. BARROWS.

EIGHTH PAPER.

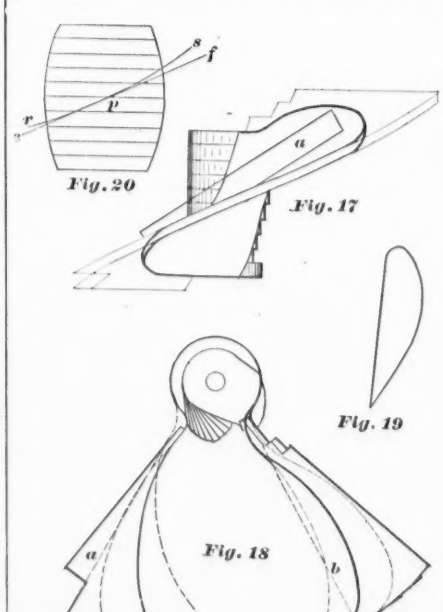
PROPELLER WHEELS.

(LAST PAPER.)

Don't forget to pull out the plug; although, as it has been in now for a week or more, perhaps it is already stuck fast. Well, get it out some way, and don't forget it next time.

While the first joint is drying we will lay out another course, getting the dimensions necessary from Fig. 8; always laying out the course on bottom side.

After the first joint has dried we will put on the third course the same way the second was done. It is a good plan to start by fastening the first course to a pair of trestles, this keeps your work up level and gives a good chance for the handscrews. When it gets up too high, shift it to the floor, always



PROPELLER WHEELS.

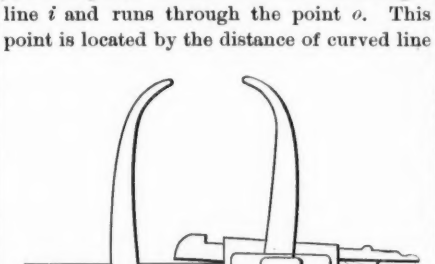
putting on one course at a time, and remembering when we get above the center to take the radius for line *l m*, the size of hub from line between courses 7 and 6 for seventh course, instead of on line between 7 and 8, as was the rule below the center. It will be seen by Figs. 14 and 15 that it requires two short courses above what is necessary for the length of hub; 15 shows the width of these courses so plainly that I don't think it is necessary to say anything further about them except that they are to be glued down on a radial line, the position of which is governed by the width of courses at the end of blade.

It is well to try the wheel three or four times when gluing up to see that the courses or joints are kept parallel with the first course laid down. If you allow them to run out of parallel lines your wheels will be crooked.

The job as it now stands will look like 14 and 15, with the courses marked *x* and *y* left off.

Now let us see what the result would be in case we had used the modification of a straight pitch as shown by lines *i k* and *l o*, Fig. 8. We will lay out the first course, using these lines. Lay off the hub as before; lay on the templet and draw the radial line *b r*, Fig. 16.

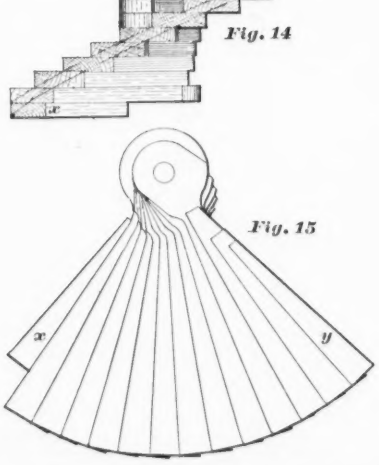
Measure with a pair of dividers on line bottom of first course, the distance between line *g h* and line *i k;* set this off on line *g h*, Fig. 16, towards *g;* then draw a straight line from end of course at *r* to the point just marked on *g h*. Again, take the distance between *i k* and *l o*. Set this off towards *g* from the last point found of this line. Now you should have a templet, the outline of which at face of bucket should start with a curve suitable for fillet, and from this should run to a straight line like Fig. 19. This is used to lay out that part of the course between the straight line at *i*, Fig. 16, and the fillet at *f*, and is placed so that it touches the straight line *i* and runs through the point *o*. This point is located by the distance of curved line



BEAM CALIPERS.

l o, Fig. 8, from the straight pitch line *g h*, measured on the bottom line of the course you may be working. This will give us a first course like Fig. 16. From this shape the face of courses gradually approaches the true radial line, until the center of wheel or hub is reached. Here and here only the face of bucket lies in a radial line. After passing the center the variation on line *g h*, Fig. 16, should be set off towards *h*.

On Fig. 18 the face of first course is shown by broken line *a*, and the face of eleventh



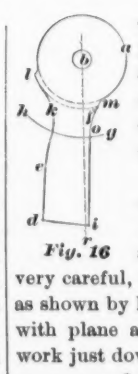


Fig. 16

course by similar line *b*. This you will see widens the section at *g h*. The shape produced also offers less resistance and is calculated to increase the backing qualities.

Now get out your adze and chop off the face of wheel. If you are as poor a hand with an adze as I am, you will need to be very careful, or you will get below the surface as shown by lines on Fig. 14. Then finish up with plane and spokeshave, being careful to work just down to the lines formed by face of courses, and don't leave the face all humps and hollows, because it won't look nice, to say the least.

After shaping the wheel to the desired outline, which may require the addition of more courses at top or bottom, as shown by the different outlines on Fig. 18; a piece is fitted across the blade as shown by Fig. 17 at *a*, and fastened on with screws. As this piece is intended to keep the blade straight while being moulded it should be fitted very closely and well fastened.

Now turn over and chop off the back to the right shape, after which the pattern will look like Fig. 17. Then, if you will "sharpen" the edge all round, your pattern is ready for sand-paper and varnish.

For an increase pitch but little further explanation is required. In the drawing, or drawings, for it is better to make as many drawings as you have sections, and on each drawing, place a line indicating some definite straight pitch; the same pitch for all sections and all crossing the same center. This pitch line together with the radial line made by templet, Fig. 9, is the starting point from which each course is laid out.

Your drawings will have the general appearance of Fig. 20, in which *r p s* represents the increase pitch line, and *e p f* the straight pitch.

All courses must be laid out from a radial line, and this radial line must always pass through some point on line *e f*. This point must also be the point where the line *e f* crosses the surface of the course you are laying out; then by measuring on the bottom line of course from *e f* to *r p s*, the desired pitch may be laid out. It will be found necessary to change the bevel of line showing pitch at circumference, and of course the width of course will vary with this line. If the position of sections is located on templets it will be easy to transfer them to courses.

Beam Calipers.

The tool illustrated in connection with this item was made by Matt Donovan, Brooklyn, N. Y. As will be seen the tool consists of the legs of an ordinary pair of calipers, each being mounted separately on plates of iron, one of which is screwed to a piece of wood ½x1⅜ inches, and of any desired length. The other leg is riveted to a sheet iron guide which encircles the wooden bar, and is held in place by a wedge. This tool is capable of being greatly elaborated, by substituting thumb screws for wedge clamping devices, and is capable of making very accurate measurements, being very desirable in many places where ordinary large calipers could not well be used. Even in its present crude form the tool possesses these and other advantages, but must be seen in order to be fully appreciated.

Blower or Chimney?

Some years ago, writes a correspondent of the *Mechanical World and Steam Users' Journal*, I tried to induce the engineering fraternity to try the effect of no chimney and no draft in lessening the consumption of fuel, and increasing the power obtained from what was consumed. I think it will readily be admitted that draft means a certain degree of vacuo, and vacuo means a corresponding degree of attenuation; a good draft means a good suction or a drawing of the products of combustion rapidly and lightly over the heating surfaces of the boiler. On the other hand, if the outlets for the products of combustion are contracted, and the air which makes the fire burn be drawn through the fire under pressure, a greater and denser body of heat will operate upon the heating surfaces than possibly can under any kind of draft—either forced or natural. If the pressure of the flame or heated gases is only to the extent of a few ounces per square inch on the heating surfaces, surely it must exert a greater power than if it is drawn lightly over the salient points by a draft that lessens even the natural pressure of the flame. A given cubical capacity of heat must be more powerful when it is compressed than when it is expanded and attenuated by the suck of the

draft; when compressed, it operates equally on every part of whatever surface is exposed to its influence. Under drafts it touches but lightly the portions of surface not immediately in its track; the flame only strikes one side of a tube, for instance, and, though it may in some cases lap round it, the contact on the draft side is very slight. Flames rushing through longitudinal tubes also touch the surface but lightly, while in corrugated flues the draft side of the corrugations is but slightly touched. In fact, the success of draft, in whatever way it is produced, depends on the free passage of the heat or flame from its source to its exit, and the fact that forced draft gives better results than natural drafts, only shows how fallacious the system of draft is under any conditions. Forced drafts give more steam certainly, but it also draws more fuel up the chimney.

A Short Chapter on Steam Piping.

By J. G. Tramis.

When *theory* (that is, a process of reasoning) and *practice* (that is, the experience of a number of people) do not agree, then it is safe to assume that the theory or the reasoning is not correct. But when the practice—that the experience of different people apparently doing the same thing—gets different results, or when practicing in different ways gets the same results, then there is a question open, which may well justify theoretical investigation.

It is not an uncommon thing to find one man who says a certain method of working is the best, and another, under what appears to be like conditions, who says the very opposite is the best. But upon investigation it may be found that the conditions are not alike, or it may be that one of the two men never tried but one way, and that had he tried the other he, too, would have thought as the other man thought, although even then there may still be a difference, not simply of opinion, but a difference in absolute results.

Simple as any device may seem, it is hardly possible to get two men to build two things alike, and equally difficult to get two men to operate two things alike. This difference in the construction of things, and the difference in the operating of things, adds to the complications when we attempt to reason and expect to have the practical results agree with the reasoning. A great many things we reason out ought to work, *don't* work, and a few things we reason ought not to work, *do* work; such things will always exist, but beyond all these, there are a great many things that do succeed that are the result of sound reasoning. So we are justified in reasoning, always bearing in mind the possibility that there may be elements in the question that we have overlooked, and the uncertainty of workmen or operations being exactly as we have assumed.

The above may seem like a long preamble to a short chapter, but will answer for the pending of a good many chapters on steam-engine practice.

There appears to be a difference of opinion and a difference in the practice of engineers as to the putting up of steam pipes from boiler to engine—whether to have the pipe descend towards the boiler or towards the engine. There is no doubt that as a matter of coal economy it is a good deal better to have the hot water in the boiler than in the engine, but that which is of more consequence in many cases, is the danger that in the attempt to get the water to the boiler, it may under certain circumstances fail to work, and so go to the engine in a flood and cause a breakdown.

Whichever plan a man advocates, as a matter of fact, if there is a sag in the pipe, water will accumulate in the low place, and sooner or later be blown by the steam in a flood to the engine. Too many breakdowns have been occasioned from this cause to admit of a doubt.

Now what is to be feared from a pipe having a slight descent towards the boiler is this: That the water tending to run towards the boiler will be prevented from doing so by the friction of the steam going in the opposite direction until a considerable amount has accumulated along the bottom of the pipe, and then, from some sudden fluctuation in the flow of steam, the water near the boiler may get started in a wave. The wave would reduce the area of the steam passage, and from this cause would be driven towards the engine, picking up the water ahead of it and taking it with it. Thus the whole area of the pipe might easily be filled, and so all the water laying in the pipe be driven into the engine in a mass.

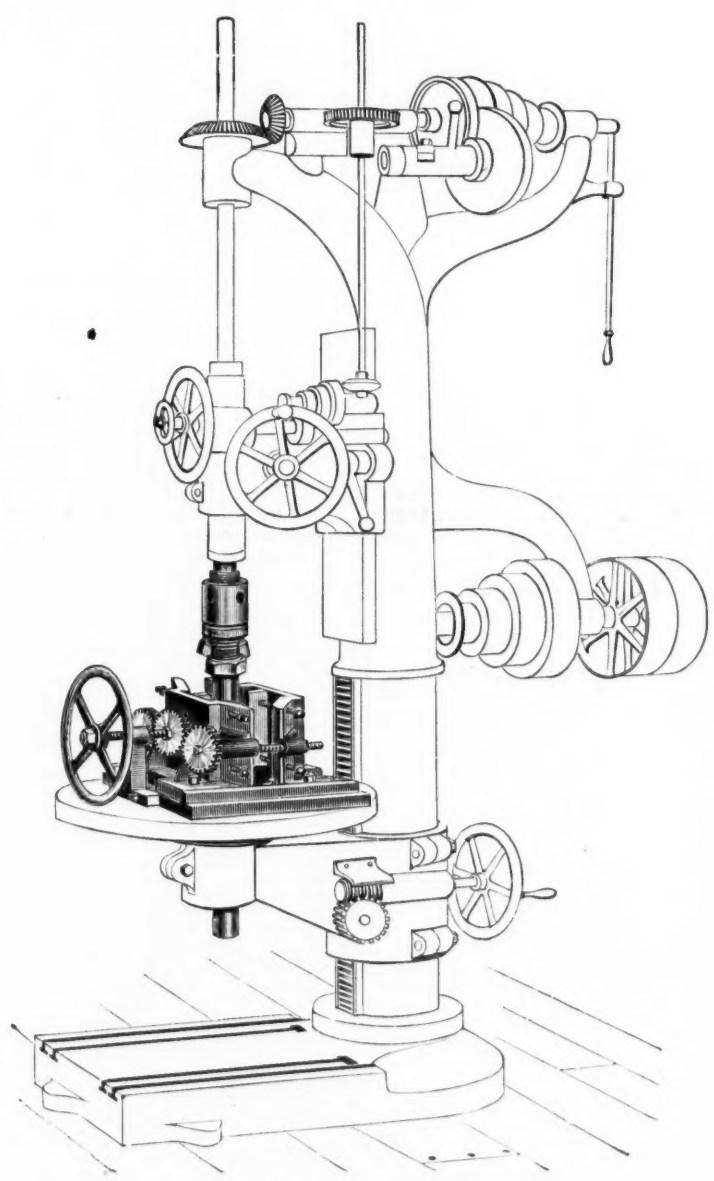
Taking this theoretical view of the question, is it not best to have the flow or descent towards the engine, particularly in high-speed engines, where the result of a deluge of water is sure to result in a wreck? In slow-speed engines, and those specially fitted for dealing with water, it may be safe, and then, of course, best, to have the pipe descend towards the boiler, but even in this case a considerable pitch will be better than a small one.

The size and length of the steam pipe, in proportion to the power of the engine, has a bearing on this point, as well as being one deserving more thought than it always receives in relation to the best results from the engine itself. It is a common thing to figure size of pipe from dimension of cylinder and speed of piston, whether the engine be automatic or throttling; and this would be correct provided the formula or rule was correct, the engine always working at its rated power, and the length of the steam pipe, boiler pressure, and many other points were introduced as elements in the formula. But it will reduce the number of elements in the problem if the plain statement of the horse-power to be developed is used as a basis. It is more than likely that a throttling engine, ample in size for its work, can be supplied by a smaller pipe than an automatic cut-off engine, if the best results are expected from the latter. As a strange example in this connection, it has been reported to me that in a case where a 4″ pipe was used to carry steam two or three hundred feet to supply a 60 horse-power slide-valve engine, the engineer was told that his steam pipe was too small—a statement he did not believe—and to test it he put in a 1¼″ pipe by its side, and found that he could run just as well, and fully as economically, as with the 4″ pipe. If the story is true, then it is more than probable that, instead of using 60 horse-power from the 60 horse-power engine, he was not using one-half — possibly not one-quarter — of its full capacity, and so his 1¼″ pipe was simply throttling the steam, instead of its being throttled by the governor.

In the case of an automatic engine it is essential the steam be admitted to the cylinder at as near boiler pressure as practicable, and to do this requires a large pipe. If automatic engines all worked with equal economy, then for a given horse-power one 60 horse-power engine would require as large a pipe as another, regardless of piston speed or cylinder capacity; but as they are not all of equal efficiency, then the least efficient requires the larger pipe. Too large a pipe is objectionable, not simply on account of cost, but also because of the extra condensing surface wasting heat and giving more water to be dealt with in the cylinder, if the water is drained in that direction. This would point to the following conclusion in regard to the pitch or incline of the pipe: If, of the two, the pipe is extra large, it might well pitch towards the boiler, and if too small, towards the engine.

In the case of very long pipes, they should be larger in diameter for the same engine, and likely the more economical arrangement would be this: If 3½″ is large enough for a pipe 40 feet long, but not for one 100 feet long, then let the first 60 feet from boiler be 4″ and the last 40 feet 3½″ pipe.

A table of reference suitable for the modern high-speed engine, would be a convenience; perhaps there are such tables, but if reliable, they must be based on some assumed decrease in pressure between the boiler and engine. Some men might be willing—or in certain cases any one might be satisfied—to have the pressure in the steam-chest five per cent. below boiler pressure, while in another case two per cent. might be as much as would be justifiable, and whether the one or the other of these requirements be complied with will make a vast difference in the size of pipe required. Unquestionably, there are engines running unsatisfactorily with a limited boiler pressure, where, if the engineer was allowed 5 lbs. more pressure, he could do the work satisfactorily. Where such is the case, then the question of steam-pipe size is of great importance. Before putting in a new boiler for lack of a few pounds of steam, see if some pressure is not lost through too small or crooked steam pipes.



Car Box Boring Attachment.

Car Box Boring Attachment.

The device shown in cut is a very simple, effective and inexpensive arrangement for boring car axle brasses. A chuck arranged to be fastened to the table of an ordinary drill press with automatic feed and quick return holds the brasses to be bored, and by simply turning the hand-wheel they are brought together and firmly held in place. A double adjustable cutter bores two brasses at a time; the brasses being less than a half circle, strips are placed between their faces. These strips or parallels are held separately by the set-screws, and need not be disturbed when once adjusted for certain sized boxes. When different sized boxes are to be bored, then other strips are required.

The operation of setting the boxes is as simple as screwing up a vise. The two jaws are adjustable, and move towards the center at one time, firmly holding the brasses against the strips. Below the chuck is a bearing for cutter-bar, which is kept free from chips and dirt by a rubber ring, giving a good opportunity to oil. This cutter-bar is fitted into the taper hole in end of drill press spindle. Through it a slot is made, and two cutters with ends rounded, are made to form a hinge or pivot for each other. The end that does the cutting is shaped so that a good cutting edge is made when the cutters are set close to bar for a small hole, or extended for a large one. They are designed to bore all sizes of car axle brasses with one set of cutters. The ends of the cutters are thickened to have a grinding or sharpening surface, and are sharpened by grinding on the face of them. They are extended or contracted by a nut and washer, top and bottom of cutters, that admit of very fine adjustment. This device can be very quickly put in place and at work, and when once adjusted can be easily operated. By having ring gauges on the bar hung up over the cutters, they can be often tried and the cutters adjusted to bore standard sizes.

The device shown is made by the L. B. Flanders Machine Works (Pedrick & Ayer), Philadelphia.

According to bills before the Connecticut Legislature, no child under 12 years of age may be employed in a factory, and minors and women shall not be employed more than 60 hours in a week.

English writers upon the question of the favor with which American locomotives are received in foreign countries are far from being agreed as to the reason. One class of writers on this subject argue that it is because so many locomotives sent out from England to South America are too much copies of American locomotives; another class that the reason is because locomotives for export are *not* copies of those made in America.

If an emery wheel is out of round and jumps in use, a piece of bar copper, used instead of a diamond, and held on the rest firmly, so as to come in contact only with the high portions, will remove such portions and restore the wheel to a true surface faster than many would suppose. It is a good substitute for a diamond. The wear and loss of one ounce from the copper now and then is less costly than the diamond.—*Blacksmith and Wheelwright.*

The Sherman, Tex., *Register* says that town will have a paper mill in operation within twelve months.

LETTERS FROM PRACTICAL MEN.

Steam Heating vs. Furnace Heating.

Editor American Machinist:

In your issue of March 27th there is an article entitled "Heating Dwellings by Steam," speaking favorably of that method of heating houses, and disparagingly of furnaces.

I cannot think the writer has given much thought to the subject. He says that, "one of the prime causes of the failure of furnaces is the difficulty experienced in attempting to force currents of warm air through a house in a contrary direction to that from which the wind is blowing. That inequalities of temperature in various parts of a house so heated usually result in drafts, etc. Also that the presence of dust and coal gas are items to count on." And much more to the same effect.

I have a house situated on a hill, exposed on all sides, heated by a furnace, but have never experienced any of the difficulties mentioned. I consider a furnace, properly constructed and erected, to be (next to the open fire place) the best method of heating and *ventilating* known, and infinitely superior to steam. One of the principal reasons why a furnace fails to send air into a room is a lack of any means to get that air *out of the room* when cooled off. With doors and windows tightly closed and the room full of cold air, how is it possible to force any more in, particularly warm air?

As for the presence of dust, of course there are some furnaces erected by people so careless or ignorant of the laws of health and cleanliness that the air sent up into the rooms to be breathed is taken from the cellar—not a particularly pleasant place in many houses—and when ashes, etc., are being removed it would be strange if the dust floating about should separate itself from the air and remain in the cellar while the air passed up into the rooms above.

If the supply of air is taken from the outside, and the connection to furnace made perfectly air tight, where is the dust to come from?

The advantages a furnace has over heating by steam are:

First, and most important, a supply of fresh, warm (not hot) air, and a complete system of ventilation not possible with steam, as usually used in radiators; and second, if the furnace be of ample size and the supply of cold air sufficient, it will be found that the air will not need to be made hot, but merely warmed, so that it enters the room at a temperature only a little higher than the desired warmth of the room.

By this means the moisture is retained, and we get the air in the house same as outside, except that it is warmed. And this is one point where a furnace is so superior to steam heating; for notwithstanding the extraordinary statement in the article referred to, that "the pleasantly moist condition of the air is also worth noting," it is a notorious fact that air heated by steam pipes is the dryest and most unpleasant to endure of that obtained by any system of heating; a fact well known to and taken good advantage of by those engaged in constructing drying chambers for various purposes. And there is no reason why it should not be so, for what do the hot steam pipes do but heat the air that is already in the room, and as it cools re-heat it again and again, gradually but surely extracting all the moisture out of it, for how the steam *inside* the pipes can impart its moisture to the air *outside* of the pipes I fail to see, unless they leak.

What more is desired than a room full of warm, pleasant, fresh air, constantly changing? As to gas rising in the rooms from the furnace, that is a matter easily prevented by using a furnace with a steel or wrought-iron radiator, that will not allow gas to escape through it, as cast-iron will under heat.

To ensure perfect heating and ventilation (for the two are inseparable) from a furnace, the following points must be observed: There should be ventilating shafts built alongside of the chimneys, so that they will be warmed by the latter; this is an important point, as it is useless trying to get the air to ascend a cold shaft unless a strong up draft exists. Connection to these ventilating shafts should be made *near the floors* of the rooms, so that the air that is removed is that which has been longest in the room and consequently the coldest and most desirable to be got rid of.

The cold air connection to furnace should be large and perfectly air tight, so that no air can pass the furnace except that which comes from the outside through the cold air-box. For a furnace of say 45 inches diameter of casing, the cold air-box should have a sectional area of not less than 300 square inches, and fitted with slide damper to regulate with in windy weather.

And lastly, in purchasing a furnace select one that is so constructed that it is impossible for any gas to escape from the fire-box, except to the chimney, which latter should be of good proportions *clear to the furnace*, and not made so small at the connecting smoke pipe as to cause gas to escape through furnace door when open, as is very frequently done. If these suggestions are followed out there will be no difficulty experienced in obtaining a sufficient supply of fresh, warm air, free from dust or gas, into any room in the house.

S. A. Beckett.

Arlington, N. J.

Truing Milling Machine Centers.

Editor American Machinist:

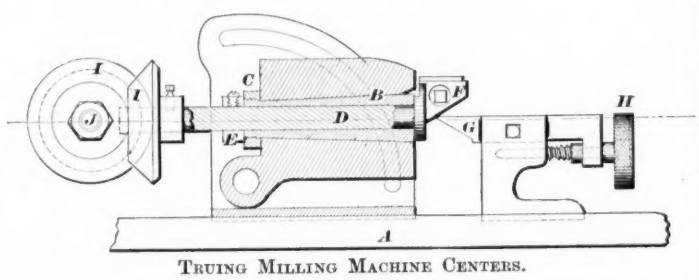
The accompanying illustration shows a device for truing the centers of universal milling machine cutters, in which *A* is the bed of the machine; *D* the shaft, held in place by a collar; *C* and *B* is a sleeve, fitted to head of machine, and held by nut *E*. The cutter *F* is screwed to head of the shaft *D* with cutting edge on center. The adjustable center *G* in the tail block is moved to the cutter *F* by hand-wheel *H*.

The small bevel gears *I I*, one on shaft *B*, the other on machine spindle, serve to impart motion to the cutter *F* through shaft *D*.

I never saw anything like it before, and it works nicely.

W. R. Ballou.

Stamford, Conn.



Truing Milling Machine Centers.

Tapping and Drilling Device.

Editor American Machinist:

The accompanying sketch shows a lathe attachment, which I constructed and used for the purpose of drilling and tapping flanges, as the work is revolving in the lathe. The device may not be new, but it is new to me, at all events. It was used principally for drilling and tapping the flanges of yoke valves, which it will do in a speedy and accurate manner.

Fig. 1 is a side elevation, Fig. 2 an end view, and Fig. 3 the templet that covers the work. The construction is as follows: *A* is a flat-shaped casting, with a hole bored its entire length to receive the spindle *B*, and also planed out crosswise to receive the piece *C*, which holds the drill chuck, and which is adjustable for different-sized flanges by sliding in and out.

The templet *D* is bolted to the flange to be drilled. The spindle *B* has a gear firmly keyed on at *E*, and is held by the chuck *F* in the tail-stock of lathe.

The templet *D* has a bolt or carrier *G*, which fits easily the dividing plate *H*, which in this instance is divided by four slots, as in Fig. 2.

In order to provide adjustment for flanges of a larger or smaller diameter, it is fitted with an intermediate gear *I*, Fig. 2, which will allow an adjustment equal to the diameter of the intermediate gear.

The operation is as follows: The flange is first faced off and bored out to the proper size; the templet firmly bolted to it; then the spindle of the machine is inserted in the drill chuck in tailstock and the set screw tightened down, the other end of the spindle passing through the hole in the center of the templet and the carrier bolt *G*, entering one of the slots in the dividing plate *H*.

The lathe is then started up, and the tail spindle screwed out as you would do in ordinary drilling; the gear *E*, which, with the spindle *B* is stationary, causes the other gears to rotate as they revolve around it, thereby causing the drill *K* to rotate on its own axis, drilling in the meantime a hole which is at once true and square. When the holes are all drilled, the drill is removed from the chuck and a tap inserted in its place, when the lathe is again started and the holes tapped out, the whole operation requiring less time than it would take to strap the work on the drill press, to say nothing of the drilling and tapping.

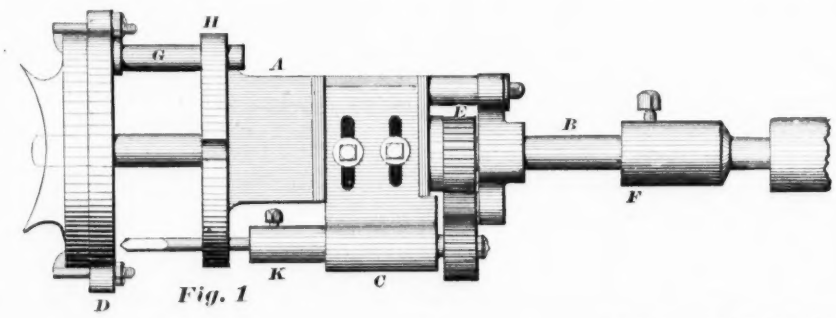


Fig. 1

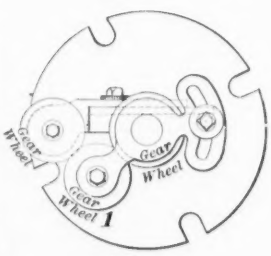


Fig. 2

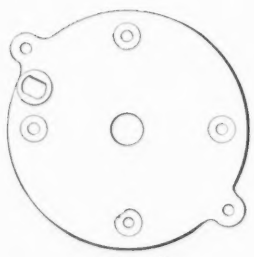


Fig. 3

Tapping and Drilling Device.

Jas. C. Osborne.

Erie, Pa.

Heater and Boiler Connection.

Editor American Machinist:

One of your correspondents asks for some way to keep the water from leaving his heater and filling up his boiler. If he will put a ½-inch check valve on lower pipe and fix it so that the water will run from boiler to heater, he will find that the water will keep up a circulation as long as he has fire in heater, and will keep the water in boiler at right level, no matter whether heater is above or below water line, except when there is a very hot fire in heater, when by closing dampers the water will come to its own level again. I have got one that I run that way and find it works well.

Peter Martin.

Dubuque, Iowa.

Pay Day, With Cost Accounts.

Editor American Machinist:

Your correspondent, "G." (March 20), and F. J. Masten (March 27), induce me to write this:

First as to "G.": An early form of the card system of shop accounts, described in "The Cost of Manufactures," permitted the employes of Frankfort Arsenal to be paid on the last day of each month.

This will not seem much to some private shops, unless they know that the roll has to be classified before payment under ten or twelve appropriations, according to the objects on which the labor has been expended.

Second—I would ask Mr. Masten if the young men whose failure he describes had an automatic method of getting at the cost of the machinery they manufactured, whether their profits might not have been controlled, and the disturbance to trade, caused by the cut-throat war which he describes, have been prevented?

Henry Metcalfe.

Heating by Exhaust Steam—The Result of Thoughtlessness.

Editor American Machinist:

I am not constituted so differently from other people that I take pleasure in calling public attention to my blunders, but if I can place them in a light so that they will be of use to others, I do not wish to keep them under darkness. Wishing to utilize the exhaust steam from my engine for heating my building, and having a large furnace made of an old boiler shell, I made it into a radiator by closing the doors in both ends and securing them with bolts, and cementing with a mixture of linseed oil, air-slaked lime, sand and litharge. As far as tried, this worked satisfactorily; but not having a tank to condense the steam after leaving the radiator yet completed, and the water supply being limited, I connected the exhaust by a separate pipe with a hogshead of cold water and snow, and when the radiator had become sufficiently heated, closed the pipe leading to the radiator and let steam pass to hogshead. When steam began to issue from drain-cock in feed-water heater more freely than I thought desirable, I closed said cock, and neglected to open it when I stopped the engine. Although perfectly familiar with the laws of atmospheric pressure, I was so thoughtless as not to consider the fact that when the steam in pipe and heater condensed, water would be forced in to fill the vacuum. When I next wished to start the engine, I blew the water from under the cylinder through the cylinder-cock, turned the engine a few times by hand and opened the throttle-valve. The result was that the inertia of the water prevented its getting out of the way fast enough to allow the piston free play and the engine came to a sudden stop, with a broken piston-rod and the packing-nut nipple broken off the cylinder. Although the damage was not as great as I at first feared yet the cost of repairs would have amply repaid for a little more care in preventing the accident.

Hoping that others may be benefited by my experience, I also hope that some who have thoughtlessly injured their engines or other machinery will write the particulars as a warning to their thoughtless brethren.

Henry A. Sprague.

Charlotte, Me.

"Lining Engine Lathes."

Editor American Machinist:

In your issue of February 20th and March 27th, current volume, I notice articles on "Lining Engine Lathes" which seem to point to a possible improvement in that direction. Now, if I properly understand the action of the devices, as shown, they would seem to be applicable to lathes in the process of construction, rather than to those already in use, and it is with the latter that most mechanics have to do.

It would seem that the devices before mentioned only partially overcome the difficulties occasioned by wear of the boxes, as the outer box of most small lathes wears on the top owing to the pull of the belt, and wear at this end is just as effectual in throwing the spindle out of line as at the main bearing. My idea of how best to correct this evil (for evil it is) during the manufacture of lathes is well expressed in a few words which I quote from the Brown & Sharpe Manufacturing Com-

pany's "Treatise on Universal Milling Machines": "Original accuracy is in a great measure retained by having the bearing of a nearly non-wearing material, and of such a shape that the uniform wear of the spindle may be taken up by longitudinal movement to counteract the tendency to get out of line." If lathe builders would do something in this line, and give up the old-fashioned half-box, which, although it has seen years of service, never was just the right thing for lathe bearings, it would be a step in the right direction.

As there are probably more lathes with half-boxes than of any or all other kinds for that matter and their general condition is *out of line*, and the usual way of lining them is by filing and shimming, a simple way to tell how much and where to put the remedy may be of use. My way is this: Get two pieces of shafting, one as much longer than the other as the distance between centers of spindle bearings in the headstock. One piece may be short, 3″ or 4″ being plenty. Have one end of each squared off smooth so a fine line drawn on it can be plainly seen; then place one piece in the chuck on lathe spindle, and having adjusted a fine pointed tool in the tool post, at as near the height of the centers as possible, scribe a circle on the end of piece. Remove this piece and having replaced it with the other, scribe a circle on its end with the tool remaining in its same relative relations to the ways of lathe. The circle may be about $\frac{1}{2}''$ or $\frac{3}{4}''$ diameter, a comparison of the diameters of these circles, which may be easily done with dividers, will show just double the amount that the bearing requires moving either forward or back; the same process repeated with the tool either above or below the center will show double the required vertical adjustment. The introduction of a third test piece, either longer or shorter than the longer of the two as mentioned above, will show whether the bed is straight or not. I would say that it has never been my fortune to find a lathe to use that would stand this test with 3 feet difference in length of test pieces, but we have one now in the shop which showed out $\frac{22}{100}''$ in 3 feet 6″ when new, that I have overhauled by this plan and now it is within about $\frac{7}{1000}''$ in the same length. This I consider practically straight for boring with ordinary tools.

Chas. S. Beach.

Fink Working Among Railroad Officials.

Fink, the bogus oil man, (now out on bail), has, so we are informed, recently taken to using his seductive arts among railroad presidents, treasurers and executive officers, who, not being mechanics, are not likely to be well posted as to him and his wares. We have lately heard of him as having victimized a numberof railroad officials in the neighborhood of New Yok and elsewhere, through negotiations for the use of his compound on locmotives and in railroad shops.

Master mechanics, car builders, superintendents, foremen and railroad shop men generally will do their roads good service by making the "merits" of Fink and his recipe familiarly known, wherever their acquaintance extends. Unless railroad mechanics take some pains in this matter, a good many officials connected with the fiscal departments of railways, may find that they have sown where they are not likely to reap a profitable crop.

A Steam Donkey.

By F. G. Woodward.

The present delineations show a novel design for a small engine suitable for auxiliary work on shipboard or otherwise. It may be placed vertically either end up, or horizontally, or at an angle to suit the location where it is to be used. It may be fastened to a timber by four bolts, *o*, as shown—see Fig. 1. The cylinder *a*, guides *b*, main and rocker-boxes, *c* and *d*, are combined in a single casting as shown in Fig. 2.

The main shaft *e* is at one end of the cylinder, and the crosshead *f* at the other. This arrangement admits of a short compact machine with long connections *g*, and gives double wrist surface and durability.

The method of fitting the crank pulleys *h* to the main shaft *e*, is clearly shown in Fig. 3, central section and plan. This style of fitting pulleys to shaft permits long main boxes *c* and wide faced pulleys *h*. The "rocker shaft" or valve driver, *i*, is worked directly by the eccentric *j*, Fig. 4. The other details are similar to those of ordinary engines.

Boiler Feed Pump.

The pump which we illustrate herewith is made by M. R. Muckle, Jr., & Co., Philadelphia. It has cut gears, steel pins, and wrought iron pinion and shaft. The check valves have yielding seats that do not require grinding. The inlet check is provided with a by-pass, by which means the feed can be regulated at will.

Boiler Feed Pump.

What the *American Furniture Gazette* says below, sounds as if it might be said of some of the machinery lines:

The Macedonian cry propounded by furniture manufacturers is heard in the land, "What shall we do to raise the price of furniture?" Well, gentlemen, raise it! Then if the dealer don't call you, raise it again and then see him. This is the only way. Interviewing each other and publishing your interviews in obscure papers won't do it. Conventions won't do it. Resolutions won't do it, and so you have got to do it yourselves.

National Labor Commissioner's Report.

Commissioner Wright, of the National Bureau of Labor, has submitted his first report, which has not as yet been printed. His conclusion is that 7½ per cent. of the industrial establishments of the country have been idle during the past year, throwing, approximately, one million operatives out of employment. This he calculates entailed a loss to the trade of the country of more than $300,000,000.

The report discusses the benefits resulting from the use of labor-saving machinery, but the commissioner reaches the conclusion that those who work have not received their full share of these benefits. Of this, however, it may be said that it is always necessary to look through considerable spaces of time to judge correctly. The first result of radical change in the direction of cheaper production in any industry is in a sense disastrous to those working in that industry, but the eventual outcome is to benefit all.

Of emigration Mr. Wright has this to say:

Legitimate voluntary immigration may be too rapid to enable a country developing its industries to assimilate labor from the outside, but when immigration becomes a subject of inducement of contract for the purpose of displacing a higher grade of labor, the result is indeed pernicious, and all the authority of law should be called in to prevent the continuance of the wrong.

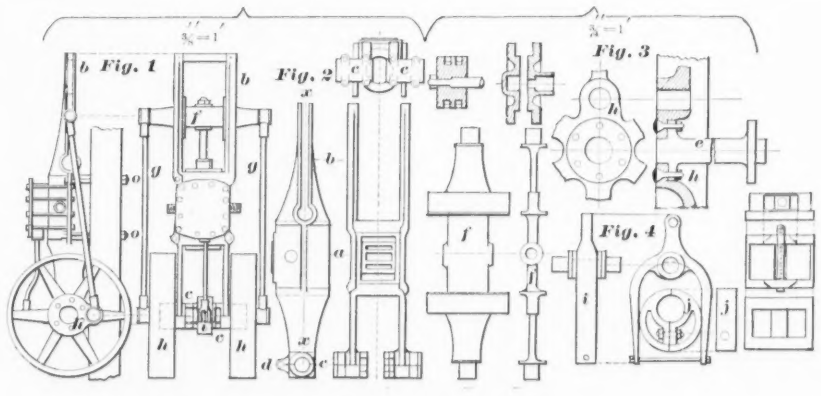
We presume that one argument in favor of the above is that the laborers thus introduced are not consumers to the same extent that those already here are, and that one prime factor in the industrial problem in this country is that all shall liberally use the products of labor.

Undoubtedly when the complete report is published, matter for serious reflection will be found in it.

There ought to be a stronger alliance between the insurance examiners and electric light companies. At present there is much misunderstanding between the electric light interests and the stock insurance companies. There is no trouble on the part of the mutual fire insurance companies, for they work with the electric people, and are a help rather than a hindrance. It is recommended that there be monthly meetings of the insurance inspectors and electric light companies' representatives; that all wiring men should be examined and have a certificate from an insurance board, and that all changes in the rules and regulations relating to the installation or operating of electric light plants should be sent to all agents and certified wirers of the electric companies. In the past plants have failed to be satisfactory to the insurance companies, because some rule recently passed and not brought to the attention of the electrical public had not been followed. Both parties should work together, for they are both using their best endeavors for the same end, *i. e.* to prevent the destruction of property by fire.—*The Electrical Review.*

An English inventor has obtained a patent on tubes for thermometers, which he claims does away with a constant gradual shrinkage that affects their accuracy. His plan contemplates a lengthy subjection to heat above any temperature they are to be subjected to, in use, and a proper formation at their upper ends to prevent injury while being annealed.

The way of the plumber is often beyond the "ken" of man. Salem, Mass., has rep-



Steam Donkey.

resentatives of the craft who lead in their profession by their peculiar piping of the hall used by the Eighth Regiment, in that place. The soldiers paid for their own gas; the Merchants' Bank paid for their own and the soldiers' gas, while the Asiatic Bank paid for the whole amount of gas consumed in the building, as part of it passed through the three meters in succession.

A well-known engineer writes us that the friction of a one-inch nut, screwed hard on its bolt, will consume about 75 per cent. of the power exerted on the wrench in screwing it down. This is in reference to question 131.

How to Make Clean, Solid Castings at the Least Possible Cost.

By Matthew Wiard.

There are many points to be considered in this problem; the selecting and proper mixing of sand for the particular casting to be made, and the manner of gating the same, etc. In writing this I have in view such castings as are usually made in machine tool, steam engine, steam pump and sectional steam boiler works, where a large proportion are to be polished and to stand a severe pressure test, and range in weight from fifty pounds to three or four tons.

There is a very important fact that is not generally known, or if known, it is not appreciated; that is, that there is *no* dirt in melted iron, and, admitting this, why should there be so many defective castings? There is no business that I am at all familiar with that is so liberally supplied with the very best of everything required to make it a success, and still the losses and the grade of work turned out in many of the first-class foundries are not to their credit.

Nearly all foundries carry in stock two or more grades of sand, if the class of work they are making demands it, giving to the moulder every facility for making good castings, and he should not be slow to recognize the fact and take advantage of it for his credit and benefit, and for the credit and benefit of his employer. Nearly every moulder knows that sand for any casting should be well and evenly mixed, and evenly and firmly rammed to the pattern. But I am not so sure that he knows that that inevitable vent wire is one of the greatest enemies both to good castings and to his success, and that it should rarely if ever be used; and in no case should come in contact with a pattern. When it does so it furnishes a channel for the air to escape unequally from the mould, when in reality the iron should cushion against it and force it through its proper channel, the pores of the sand. In the absence of perforated gas pipe, which nearly every foundry has on hand, or might have at a very slight cost, it may be drawn from under a flat surface like the pocket of a knee after the air has been forced an equal distance through the sand with other parts of the mould; and as no particular harm, at the same time be a source of great satisfaction to the moulder. In every case drop the metal from the top surface or top edge, that is if the particular casting will admit of space to do so, but in no case go below the point of the mould. Use small gates and increase their number in proportion to the weight of metal needed, but under no circumstances increase their size. Use gates from $\frac{3}{16}''$ to $\frac{5}{8}''$, but rarely over $\frac{1}{2}''$ in size, and slightly tapered to hold up the metal in order to seal the mould *instantly*, and prevent the air passing up through the metal to convert it, which would be fatal to a clean, sound casting. Use no risers or other openings, but make the gates high enough above the casting to take up the shrinkage, and when they are full stop pouring. If the metal strikes the sand or a core to support it, make the gates taper to the face of the casting, but if it drops into a deep mould the small part of gate should be about one inch from the face, so that the metal will not shoot at a particular place in the mould, but drop as from a hose with the nozzle removed. All foundrymen advocate filling the gates instantly, which is correct, and it ought to be a well-known fact that a small gate can be filled quicker than a large one, but it seems not to be the case, and nearly all foundrymen can explain it satisfactorily to themselves, aided by the mysterious little ball of dirt that appears in all cleaner gates, which we admit the presence of, but which in reality was made in that particular gate. If it is a fact that so much can be gathered from the iron while they are being filled, where does the balance of it go when it takes an additional ten or twenty hundred pounds of iron to fill the mould? All flasks as also all ladles should be perforated that the air may pass out and not through the iron to convert it.

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NEW YORK, APRIL 10, 1886.

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Two Points in Making Sales.

A veteran machinery man, whose name is identified all over the country with the successful introduction and sale of an important series of machines, said recently, that his long experience had taught him the advantage of one thing. That thing was: After every important interview with parties calling to inquire about machinery which they were likely to want, he always made it a point to post his associates or somebody, as to the results of the inquiry. Then, in case the parties should call again in his absence, as might easily happen, instead of being met with a blank stare of ignorance, forcing them to explain their wants all over again (or to go away on an indefinite promise to call again, as would more likely be the case), they would find their wants well understood in detail, and the prices, previously quoted, well-known. Intending buyers, even if not fully posted as to prices, would find, in such cases, substantial evidence that the prices were probably right, because uniform in the establishment. Under circumstances so favorable as these, the sale would most likely be completed without trouble or delay, a result that could seldom be counted on with confidence, should petty pride, or a selfish desire for exclusive credit for the transaction, keep the particulars of the first interview a personal secret.

Another very shrewd and successful dealer, during his business life, has made it a rule, in talking with customers present or prospective, never to disturb their pride by intimations, that in transactions elsewhere they had paid too much, bought a bad article, or been cheated in any way. Too many salesmen think such frankness a prime argument in favor of their own wares. This astute individual knew that such remarks would be more likely to offend purchasers than to attract them. If customers had been flagrantly deceived elsewhere, his establishment was always the last place that he desired to have associated in their minds with the natural feeling of humiliation and annoyance attending the disclosure. Early in his business life, his attention was forcibly called to the importance of this subject, by the loss of a very valuable customer, through the over-frankness of one of his employes. Though a rich man to-day, he calls himself many thousand dollars poorer, owing to the permanent loss of that customer.

Never be associated with bad news, is a motto that may be as useful to the machinery salesman as to any other individual.

False Doctrine.

The *Sun*, taking for its text a recent address by Charles Francis Adams to the students of Harvard College, argues that in the future there will be little opportunity for men to attain prominent positions in railroading except they begin with a college education. This is not the lesson of the past, nor is there any evidence that it will be the rule of the future. Without under estimating the advantages of a college education, it always has been a fact, and it is as reasonably certain as anything can be that it always will be, that men have risen to prominent positions who had the will—the determination—to rise, coupled with the inherent ability, without much reference to early educational advantages. This is a natural law, the changing of which is beyond the power of all the colleges in the world. Unless a young man has the will and ability, which no college can bestow, he will never *fill* the position; if he has these, lack of college education will not keep him out of it. The work of climbing up may be a little harder because of the lack of "education," but this will only be one more obstacle—and by no means the hardest—to surmount. Any argument contrary to this is opposed alike to common sense and the teachings of the past.

The number of college graduates, with no other qualifications for earning a living than the education obtained there, is becoming rather alarmingly great, and in one sense the advice of Mr. Adams, and the *Sun*, in effect that they begin the "profession" of railroading at the brake and on the footboard may be good, viz.: as pointing out a way of earning an honest living. But for those who have that in them which will enable them to rise, it will have no further value than, perhaps, turning attention from some of the so-called learned professions already overcrowded. The expressed opinion that there is in the future no room for those who start with little book learning, will and ought to have no weight in hindering those who have determined to rise from persevering.

Do You?

When you start out to sell a machine or introduce a new product, do you begin by enumerating the strong points of your well-established competitor's machine or product, as an argument in favor of what your listener may very reasonably conclude to be the weaker points of your own machine or product? If you do, well—don't!

A number of our English exchanges reached us during the past week in a wet and bedraggled condition, having come *via* the steamer Oregon and off-shore soundings, whence they floated with other wreckage. Several remittances from foreign subscribers also reached us in the same manner, a fact to which the condition of the envelopes and letters would have borne evident witness even without the explanatory label affixed by the New York Post-office.

Foreign subscribers who have reason to fear that their remittances may have miscarried in the Oregon, only a small portion of its total mail cargo having been saved, will do well to advise us immediately to that effect. Duplicate money orders and checks or drafts can readily be obtained, to replace such as were destroyed in the wreck.

We have received a complaint from a Massachusetts correspondent, regarding the low wages which many young men fresh from technical and training schools are willing to accept, if not to be satisfied with. We would remind our correspondent that the young men, of whose competition he complains, consider themselves, while so engaged, as merely learning the practical part of their trade, with view to making it useful to them in the future. We would further remind him, that under the old apprentice system, as in England to-day, it was quite common for young men desirous of learning a trade, to pay a premium in money for the privilege of doing so. We think our correspondent will have to trust to time for a remedy.

Honesty in Manufacturing.

We recently quoted some English opinions touching dishonest practices of Sheffield manufacturers. We find our English exchanges devoting a good deal of space to this subject; while some of them attempt to make light of the matter, others forcibly point out the inevitable consequence of such a course becoming anything like common, viz.: the ultimate loss of trade. As a matter of fact there is every reason to believe that Sheffield has suffered largely in this respect, and has lost prestige that will never be regained. Undoubtedly the "scamping" processes that are working an injury to Sheffield are largely due to efforts to meet foreign—especially German—competition, but this does not help the matter.

The lessons that may be learned by the decadence of Sheffield are universally applicable. There may be some need of studying these lessons in this country. Competition in any line of manufacture has never yet been satisfactorily met by making and selling something for what it is not. There may be a temporary advantage, but the loss is sure to come. A manufacturer may, and sometimes does, find that he is adding refinements that users do not consider of sufficient importance to pay for, and this knowledge may come to him through competition; it is more likely to come in this way than in any other. Then he may legitimately leave off these refinements, meet competition and sell upon the exact merits of what he makes. It is sometimes necessary—but generally hard—to learn that purchasers are entitled to buy what they want, even if it is not what they ought to buy. The commercial side of the question is not the most pleasant one to the manufacturer.

Competition on the basis of selling just what is represented, is satisfactory because honest, but when it comes to trickery and misrepresentation it is wiser to stop trying to compete and study the problem of manufacturing at less cost.

The daily press expresses the usual and natural indignation at the recent ferry boat collision in the river, by which three or four passengers were seriously injured. As is usually the case when such accidents occur it is easy to see how it could and ought to have been avoided. But, on the one hand, are the multitude of boats plying in the harbor and river, and, on the other, the thousands of passengers who rather unsparingly vent their displeasure at anything that savors of delay. Between keeping out of the way of the one and satisfying the other, the only wonder is that collisions are not more frequent than they are. Accidents of this kind are uncommon in the waters around New York. Of course we may hope, but hardly expect, that they will never occur.

We regret to announce the death on March 12, 1886, of Job A. Turner, long identified with the pumping machinery establishment of the Geo. F. Blake Manufacturing Company, Boston and New York, as its treasurer. Mr. Turner was for twenty years a director in a leading bank, and was highly esteemed by a large circle of business and personal friends.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(153) G. W. S., ——, Ill., asks how to temper coiled steel springs *A.*—The usual way is to harden in oil and draw the temper by "blazing off."

(154) If J. E. C., Paterson, N. J., will study the articles on "Laying Out Link Motion," by J. G. A. Meyer, in the American Machinist of May 10, 17, 26, and 31, 1884, he will find answers to all his questions.

(155) M. C. J., Oshkosh, Wis., asks: How can I produce the beautiful mottled (blue and white) appearance on finished case-hardened work? *A.*—If the case-hardening is properly done, the articles will exhibit the above described appearance without any other preparation than that of hardening.

(156) J. S., Zanesville, Ohio, asks: Is there a process known, or would a process be valuable, whereby the efficiency of a file could be increased 100 per cent. without much cost? *A.*—The best manufacturers of files make them as good as they know how. A cheap process of increasing their efficiency, as indicated, would be extremely valuable.

(157) W. L. G., Hamilton, N. Y., asks: How much power do I get from an engine 12x16 at 100 revolutions, 65 lbs. boiler pressure; also from the same engine at 50 revolutions, boiler pressure 85 lbs? *A.*—It depends upon construction. You should get about 28 and 20 horse-power, respectively. 2. What size return tubular boiler should I use? *A.*—If plain slide-valve engine, as we infer, about 15 feet of heating surface for each horse-power.

(158) W. U., Collegeville, ——, writes: We are using an upright engine, 10″x10″, running 125 revolutions, cutting off at ⅔ stroke. We consider that the engine is just fairly loaded. Our boiler is 40″ diameter, 10 feet long, with 29 tubes 3″ diameter. We use 800 lbs. of coal, by actual weight (10 hours' work), including that used in banking fires. We feed with an inspirator, and use a heater. Would we save coal by using a pump instead of an inspirator? *A.*—We see no reason to doubt that your present practice is economical. You do not state what steam pressure you use, but assuming it to be from 70 to 80 lbs., we should call a fair load for such an engine from 15 to 20 horse power, probably the latter, and should say that, with the kind of engine named, your use of fuel was as economical as could be expected.

(159) H. R., Sullivan, Ind., writes: 1. In your issue of Oct. 4, 1884, in an article on a boiler, the statement is made that "In a steam boiler under 10 lbs. pressure, water boils at 240°. Does there not have to be steam before there is pressure, and does not water have to boil before there is steam? *A.*—The water begins to boil under the pressure of the atmosphere at about 212°, then as the pressure increases the water becomes hotter, and will not boil, as stated, when the pressure is 10 lbs. above atmosphere under about 240°. You doubtless know that water boils at lower temperature on a high mountain than in a valley, because the pressure of the atmosphere is less on the mountain top. Just so in a boiler, the lower the pressure the less the temperature at which the water will boil. 2. It is also said, in the same article, that "water, when heated to the boiling point, requires 966° additional heat to change it from the state of water to steam. How can this be? Does not water generate steam as soon as it boils? *A.*—When water is converted into steam, heat disappears in about the degree named. Exactly how this occurs is not easy of explanation; you will find the matter discussed in works on steam engineering.

(160) I. L., Sturgis, Mich., writes: We have a 6″x12″ traction engine, which we run at 200 revolutions per minute, with 80 lbs. boiler pressure. It has an old-fashioned crank without any counterbalance, band wheel 44″ diameter, steam pipe 1⅛″ by 3′ long, and has one turn, which is through an angle valve. We use a 1¼″ Judson governor, and cut-off steam at ⅔ stroke with a plain slide-valve. Now, by using an automatic cut-off, set to cut-off at regular work at ½ stroke, with room to increase ⅔, if loaded to that extent, and increasing the speed to 300 revolutions, putting on a balanced crank wheel, using a 2″ steam pipe and reducing the band wheel ⅓, we conclude that at the usual work we will get the same power, with quite a saving of steam, and in emergencies, such as are frequently met on bad roads for only a few minutes at a time, it would give us greatly increased power. What obstacles are in the way of realizing these advantages? *A.*—On general principles, an engine so small as 6″ diameter of cylinder, working under the conditions of a traction engine, 80 lbs. boiler pressure, will work with as good economy at ⅓ cut-off as at a cut-off shorter. If the steam is a good deal throttled, then shorter cut-off, and hence a nearer approach to boiler pressure in the cylinder may effect a small saving. In our opinion, a cut-off such as you could readily adjust by hand, and speed about as at present, would be better for your purpose than the higher speed named and automatic cut-off. There is nothing in the way of using an automatic engine, except the expediency of doing so. 2. To what extent should the valve open for ⅛ cut-off? *A.*—For a speed of 300 revolutions the port area should not be less than one-tenth the piston area; the more you can get this open at cut-off, the better.

(161) F. M. K., Boston, Mass., writes: I have a foot-lathe with a feed screw 8 threads to the inch. I wish to make it into a screw-cutting lathe. What gears will I want, and hows hall I calculate the number of teeth in each? *A.*—Calculating change gears for screw-cutting is a very simple matter, unless the lathe is compounded. In this case, we must simply put on gears that are in proportion to each other, as the leading screw pitch is in proportion to the screw we wish to cut. If we desire to cut a screw having 8 threads per inch, it will be of the same pitch as the leading screw, therefore the gears will be alike. If, however, we want to cut 4 pitch, the gears will be 2 on spindle and one on leading screw. From this proportion we may select any two gears of which one has twice the number of teeth the other has. From this example, we may deduce a rule that may be pasted in our hat, or, better still, in our brains. Once get accustomed to the above method, and the table accompanying a lathe need never be consulted. Another rule, to go with the above, is: When the thread to be cut is finer than the leading screw, put the larger gear on leading screw. Where a coarser thread than that of the leading screw is to be cut, put the smallest gear on the leading screw. For 8 threads per in. we may put gears which have the same number of teeth on both spindle and screw. For 10 threads per in. 48 teeth on spindle, 60 on screw. We may also use gears of 24 and 30 teeth, or 32 and 40, or 48 and 70. The number of teeth or size of gear is immaterial, provided the ratio of the number of teeth in the gears is the same as between pitch of screw and thread to be cut, as before stated. For 14 threads to the inch, use 24 and 42 gears; 16 threads, 24 and 48; 18 threads, 32 and 72; 20 threads, 24 and 60, and so upwards. The smallest gear practicable to use will be about 18 teeth; the largest needed 144; between these extremes gears may be made to cut any thread from 1 up to 64 threads per inch. When making or grinding thread tools, make the two cutting edges stand at an angle of 60° to each other, as near as possible, and always use a gauge for that purpose.

(162) S. J. R., Detroit, Mich., writes: In setting a boiler to burn soft coal, would grates 40″ from boiler be better than 36″? *A.*—Under some conditions, 40″ may give the best results; the tendency among engineers is to increase the distance from grate to boiler, and, in some cases, a distance of 42″ has been used. 2. Should grates be set low at front end of furnace, or low at back end? *A.*—We prefer them level. 3. Should a bridge wall be level, or should it conform to the shape of the boiler? *A.*—It does not make much difference. We should make the bridge wall level. 4. I know of a boiler where the bridge wall is about 12″ from the boiler at the front end, and 24′ at the back end of the boiler near the furnace chimney, which smokes terribly. Do you think the space should be larger toward the back end? *A.*—It is customary, for soft coal, to have a combustion chamber back of the bridge wall. Such a chamber furnishes space in which the hot air and gases can combine. To a great extent smoking is prevented by such construction. 5. Is there anything pertaining to the construction of chimneys which will lessen their tendency to smoke? *A.*—You will find information concerning chimneys in the AMERICAN MACHINIST of March 27. 6. How is the weight of a steam vessel estimated? *A.*—By calculating the displacement of the vessel; or, in other words, by estimating the number of cubic feet of the vessel which is under water; then the weight of the vessel is equal to the weight of the number of cubic feet of water displaced. 7. How is the carrying tonnage of a vessel estimated? *A.*—It may be estimated by calculating the displacement, as above, of the contents of the vessel between the light and load lines, respectively. 8. Can an object propelled by wind or water outstrip in speed the force which propels it? *A.*—No; not if moving directly with the wind. Sailing at an angle, it is claimed that an ice-boat may sail faster than the wind. 9. Can you give me a method of determining the pitch of a screw propeller? *A.*—Consult the papers upon making propeller wheel patterns, by F. W. Barrows, which commenced in March 20th issue of the AMERICAN MACHINIST.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

Alt, Mechanical Engraver on Wood, 318 B'way., NY

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Patent Attorney and Expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, NY

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Screws and turnings in brass, special shapes, estimates made on samples; Ottumwa Iron Works, Ottumwa, Ia.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

"Morrison's Practical Engineer." A complete treatise (200 pp.) on steam and general mach. Mailed on receipt of $1. W. A. Morrison, Box 373, Lowell, Mass

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See April 3, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

10,000 users machinery, tools, steam engines, boilers, etc., in N. Y. & N. J. Best *Trade Directory* ever issued. Send for circular. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for 5 or more copies.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by Angus Sinclair, 175 Dearborn street, Chicago, Ill.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. For sale by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

The Rosena Furnace, at New Castle, Pa., is to be put in blast.

F. E. Alleyne is erecting a furniture factory at Kissimmee, Fla.

R. F. Wallis & Co. are about to build a plow factory at Bellbuckle, Tenn.

The Boston & Maine Railroad has adopted the weekly system of payments.

Athersen, Harvey & Kebblers will soon start a stove foundry at Greenup, Ky.

W. F. Adams, Corinth, Miss., intends to add a machine shop to his iron-works.

The Johnston Railroad Frog and Switch Works, Chester, Pa., are to be enlarged.

The Gondola Tannin Co., Huntingdon, Pa., will double their plant of machinery.

The Westinghouse Air Brake Co., Pittsburgh, Pa., has commenced working full time.

The Meriden (Ct.) Britannia Company will commence weekly payments April 1st.

Thomas H. O'Connor will build a hardware factory on Gold street, Brooklyn, N. Y.

The Boston & Maine Railroad intend to build shops at Oak Island (Revere), Mass.

Fort Porter, Buffalo, N. Y., is to be rebuilt. Address Secretary of War, Washington, D. C.

Fisher & Thomas, Pittsburgh, Pa., will rebuild their works recently destroyed by fire.

The American Tube and Iron Co., of Middletown, Pa., propose to erect works at Pittsburgh.

The Cedar Falls Mfg. Co., Cedar Falls, Ky., are enlarging their stock of cotton machinery.

L. Baker & Sons, will build an addition to their woodworking establishment at Richford, Vt.

A new paper mill is to be built at Monico, Wis., by the Appleton Paper Company, Appleton, Wis.

Sanderson Raisner intends to build a shop for the manufacture of quarry machinery at Bangor, Pa.

W. L. Atkinson, 23d and Race streets, Philadelphia, Pa., will build an addition to his foundry.

Wolstencroft & Sons will build an engine room at Mulberry and Bridge streets, Philadelphia, Pa.

The Panhandle railroad shops at Columbus and Dennison, Ohio, are to be lighted by electricity.

Hilton & Erwin, Charlotte, N. C., are about beginning the erection of a cotton mill at that place.

The Ford Lumber Co., Ford, Ky., will add a large amount of machinery to their planing mill plant.

The Barbour Flax Spinning Co., Paterson, N. J., will enlarge their establishment at Allentown, Pa.

A $16,000 bridge is to be constructed by the Board of Village Trustees, at Ovid street, Seneca Falls, N. Y.

The Fairchild Paper Co., East Pepperell, Mass., will increase the wages of their employes on April first.

The Goodyear Metallic Rubber Shoe Company intends to move to Bridgeport from Naugatuck, Conn.

The Quincy Plow Works, Quincy, Ill., recently damaged by fire, will be put in running order at once.

The shops of the Cincinnati, Washington & Baltimore R. R., at Zaleski, Ohio, were burned March 20. Loss, $40,000.

The Wauseon Light and Fuel Co. has been organized at Wauseon, Ohio. It will bore for natural gas.

The Standard Nail and Iron Company, of Middleport, Ohio, will soon commence the manufacture of steel nails.

The Wisconsin Sulphite Fiber Company is building a mill at Monico, Wis., for the manufacture of paper pulp.

The Philadelphia and Reading Railroad Company intend to build a large roundhouse at Communipaw, N. J.

The Amsterdam Electric Light Co., Amsterdam, N. Y., will erect a building to accommodate a $50,000 electric light plant.

The Paris Mfg. Co., H. F. Morton, agent, Paris, Maine, will rebuild their wood-working factory, which was recently burned.

William Steele & Son will erect a large brick factory on Tioga street, between Trenton avenue and Waterloo street, Philadelphia, Pa.

The American Bolt Co., Lowell, Mass., make a specialty of bolts for railroad work. They are running nights to keep up with orders.

A determined effort is being made to establish a chair factory at Parish, N. Y., there being plenty of cheap material in the neighborhood.

H. J. Dexter & Son, Dover, Me., will build a new mill during the coming season. They will make a specialty of manufacturing hard wood.

A cartridge factory, said to be the first one in Canada, gets its machinery from the Farrel Foundry and Machine Co., of Waterbury, Conn.

Engines, shafting, machinery, etc., will be required by the new company, with $1,500,000 capital, now forming to carry on the extensive oatmeal and cereal business of Ferdinand Schumacher, of Akron, Ohio, recently burned out.—*Iron Trade Review.*

Pedrick & Ayer have been appointed sole agents for Philadelphia and vicinity of the St. John self-adjusting cylinder packing, illustrated in our March 27th issue.

M. Bramwell, Box 21, Allegany, Catt. Co., N. Y., is interested in forming a company to build works for the manufacture of his compound balance engine and other machinery.

The citizens of Cornish, Me., have raised $13,000, which they offer, with a 300x40 building, fitted with engine and shafting, to any responsible party, free for ten years, who will start a shoe factory.

The Acme Machinery Co., Cleveland, Ohio, have issued an enlarged pocket catalogue of bolt and nut machinery, which will be sent on application. It contains 72 pages, and illustrates quite an extended line of tools.

The Ottumwa Iron Works, of Ottumwa, Iowa, having completed their new automatic screw machine, the invention of Mr. Johnston of that concern, have added a new line to their manufactures, that of making special turned shapes in brass, and small articles of that kind.

Gaar, Scott & Co., Richmond, Ind., have issued their 1886 illustrated catalogue of agricultural engines and machinery. In addition to illustrations and descriptions of machines, it contains in the body and supplement, numerous testimonials from those using their machines.

The Blake Crusher Co., of New Haven, Conn., will erect another large mill next summer. C. H. Stuck & Son, Harrisburg, Ill., are building a new planing and moulding mill. The Harding Paper Co., of Middletown, Ohio, will rebuild their mills at Excello.—*New Enterprises.*

A large part of the idle plant of Brown & Bros., Waterbury, Conn., has been sold to E. F. Randolph, of New York, treasurer of Bradstreet's commercial agency, and Geo. H. Cloves, formerly of Brown & Bros. The sale includes most of the extensive brick buildings, hydraulic machinery, and 450x125 feet of land.

The National Water Tube Boiler Co., New Brunswick, N. J., write us that their boiler business is constantly increasing. They have recently taken orders for between 300 and 400 H. P. of the Moore water tube boiler from the Mount Vernon Mills, at Baltimore, Md. This last named company is making extensive additions to its mills.

The old Omaha Iron Works, Omaha, Neb., have been reorganized, and will hereafter be known as the Paxton & Vierling Iron Works. The works will at once enlarge their facilities for manufacturing all kinds of architectural ironwork, vault, sidewalk and platform lights and sewers. The manufacture of steam engines will be a specialty. Aside from this they will manufacture boilers, hoisting and mining machinery, hand, steam and grain elevators, brasswork, shafting, pulleys, etc.—*Iron Age.*

According to the *Textile Record*, a new company, the Union Silk Manufacturing Company, has been incorporated at Paterson, N. J. Capital stock, $60,000. Incorporators, Alexander Pfeffer, Paterson, N. J.; C. A. Auffin Oodt, Paris, France; John F. Degener, Wm. Degener, New York; A. W. Von Kessler, Paris, France. Attorneys, Seward, Da Costa & Guthrie, 29 Nassau street, New York City. Object: Manufacture from the raw material, spun silk and silk fabrics of all kinds, and sale of same.

At Birmingham (Ala.), in spite of the unfavorable freight rates now in effect on pig iron to the North and West, the condition of the iron and fuel trades is far from being, in this district, what the coke troubles have made it in the East. Pig iron is stiff, and the furnaces are doing big work. More iron ore has been mined in the past week than ever before. The coking plant of this district has all it can do to supply the present demand, so new arrangements will have to be made for two new furnaces now being built, and for which bids have already been asked for from coke men. The Pratt Coke and Iron Co. alone expect to build 300 more ovens this spring.—*The Tradesman.*

It is announced, says the *Railway Age*, that the Huntingdon Car Works, located at Huntingdon, Pa., have been purchased by the Roberts Brothers, of Philadelphia, and may be used in future for another purpose than car building. It would seem that the increase of car shops during the past few years has exceeded the demand for cars, and the shops named, with several others, were, as a natural consequence, obliged to suspend. We learn that it is proposed hereafter to utilize the machinery and other appliances connected with these shops in the manufacture of material for iron bridges, but the question has not yet, we believe, been finally determined.

Americans who are pleased to see American ideas adopted abroad, will note with satisfaction that Mr. John G. Mair, an eminent hydraulic engineer of the firm of James Simpson & Co., London, builders of pumping engines, visited this country, with an assistant, for the purpose of noting the operation of the Worthington High Duty Engines. An engine was put entirely under his direction, and was run for several weeks under various conditions of steam and water pressure, regular observations being made and careful records kept. As a result, the above named well-known firm have made arrangements whereby they will manufacture, under license, these engines for the English and Colonial markets. In a circular this firm say: "We are prepared to guarantee as high a rate of duty, consequent economy in consumption of fuel, with these engines as has been hitherto obtained with the most refined type of crank and fly-wheel or Cornish engine, while the simplicity of construction, and consequent immunity from repairs, commend them to all users of pumping machinery."

Machinists' Supplies and Iron.

NEW YORK, March, 25, 1886.

The market has been steady and quiet. The new business which comes to hand is not very encouraging.

Iron—In American pig the contract deliveries nearly absorb production, and other purchases are small for immediate use. No. 1 X, Foundry, at tide water, $17.00 to $17.50; Standard, Lehigh and North River, $18.00 to $18.50; Grey Forge, $16.00 to $16.50.

Scotch Pig—Quiet and steady. Coltness, $20.25 to $20.50; Glengarnock, $19.50; Gartsherrie, $19.50 to $20.00; Summerlee, $20.25.

Lead—Dull at 4.85c., to 4.95c.

Copper—Moderate demand. Lake, 11⅛c.

Tin—Banca, 22¼c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Correspondence with parties wishing manager or supt. Address, R. G., AM. MACHINIST.

Wanted—Position as foreman pattern-maker; first-class references. Address Box 6, AM. MACHINIST

Wanted—A machinist that can do all kinds of work in a job shop. R, K. Teller, Unadilla, N. Y.

Tool-makers wanted; 4 to 6 months' job; to first-class men, $3.50 per day for the above; second-class men, ½ days' job at 00/100. Love Mfg. Co., Rochester, Pa.

Wanted—Situation by a practical machinist; marine or stationary engine work and general jobbing; can use indicator. Address Indicator, AM. MACHINIST.

Wanted—A thorough machinist, of pleasing address, wants to travel, representing a first-class machine manufacturer. Address A. T. M., AM. MACHINIST.

Situation Wanted—By a young man in some mechanical business; practical experience, with collegiate education; capable of doing drafting and general office work; correspondence solicited. Address J. L. L., No. 18 N. Calhoun st., Baltimore, Md.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Compound; ever reliable, never failing. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

C. F. Langston & Co., 222 N. 5th st., Phila., can-makers' tools, presses, dies and special machinery built, rotary cutters made and gronnd.

Martin Bros., manufacturers, Lock Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

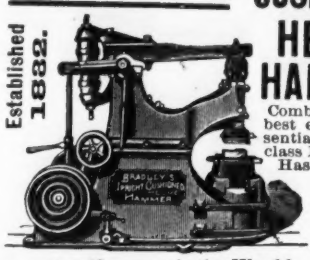
Engine and Boiler—30 horse-power Buckeye engine; 42"x12' tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until May. 1. Address Geo. A. Barnard, 70 Astor House, New York.

For Sale—Canadin patent of J. H. McGraw's Patent Adjustable Tube and Hose-Coupling Expander, the only adjustable roller expander made to a firm with light machinery; this is a good opportunity; used and indorsed by leading firms in U. S.; price low, as my U. S. business is all I care to attend to. J. H. McGraw, 187 W. 8th st., Oswego, N. Y.

For Sale or to Rent—The Honesdale Iron Works, established over forty years and doing good business, are offered for sale or to rent on satisfactory and easy terms, or an experienced man having some capital might be taken in as partner. Apply to M. B. Allen, Honesdale, Pa., or to W. W. Wood, Room 34, 117 Nassau st., New York.

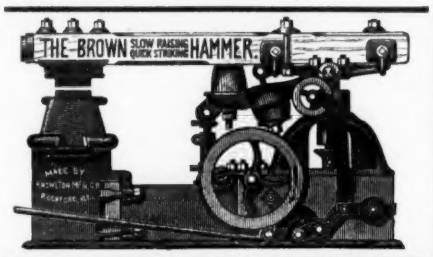
BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.



THE BROWN HAMMER

STRIKES A BLOW WITH

DOUBLE THE VELOCITY That it Raises the Hammer.

A NEW MOVEMENT! SEND FOR DESCRIPTION.

KNOWLTON MFG. CO., King St., Rockford, Ill.

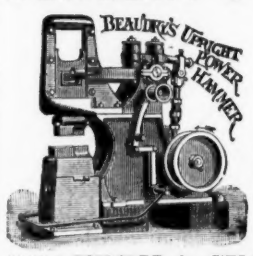
FOR SALE AT A BARGAIN.

A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,

A. FALKENAU,
Care of Dickson Mfg. Co.,
Scranton, Pa.

Only reason for selling, ill health.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER.



By far the Best. Blow Accurate, Powerful and Elastic

Will Increase the Profits of any Shop.

BEAUDRY & CUNNINGHAM,
BOSTON, MASSACHUSETTS.

H. W. JOHNS' ASBESTOS

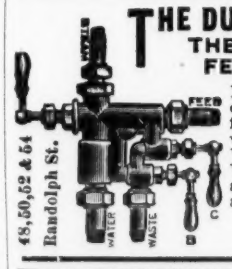
Roofing, Building Felt, Steam Packings, Boiler Coverings, Fire Proof Paints, Cements, Etc.

Samples and Descriptive Price Lists Free.

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.
175 Randolph St., Chicago; 170 N. 4th St., Philadelphia.

THE DUPLEX INJECTOR

THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

JAMES JENKS & CO.,
Detroit, Mich.

STEWART'S IRON FIBRE PAINT

COLORS RED AND BROWN.

For painting ROOFS, FACTORY and FARM BUILDINGS, FENCES, IRON WORK, EXPOSED BRICK WALLS, &c. Made of Pure Linseed Oil and highest grades of Iron Oxide. Send for Circular. Address

W. H. STEWART,
74 Cortlandt Street, New York.

READY ROOFING, for new roofs.

WHITE'S FLEXIBLE METALLIC FILLET,

For use of Pattern Makers. Sizes 1-2 to 1 in.

HOWARD WHITE, 44 N. 4th ST., PHILA. PA.

J. C. HOADLEY,
CIVIL AND MECHANICAL ENGINEER
and Expert in Patent Causes,
28 STATE STREET, ROOM 28, BOSTON, MASS.

STEPHENS VISES.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.

MELVIN STEPHENS, Prop'r,
Office, 41 Dey St., New York.

ANNOUNCEMENT!

We have just issued a new and very complete Illustrated Catalogue, which we will be pleased to mail to our patrons and others on application.

KNOWLES STEAM PUMP WORKS,
93 Liberty Street, New York,
44 Washington Street, Boston.

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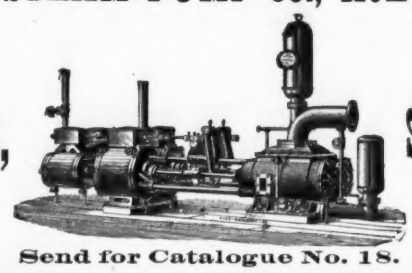

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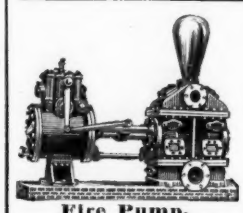

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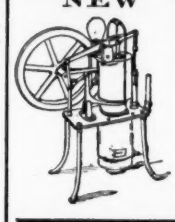

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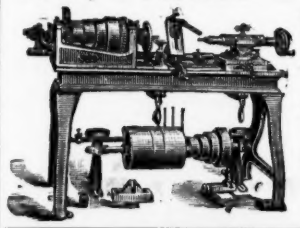

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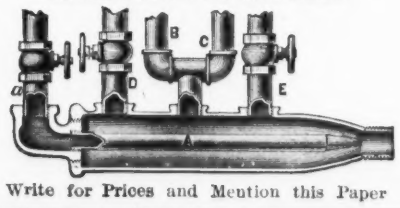

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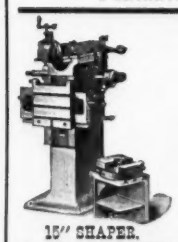

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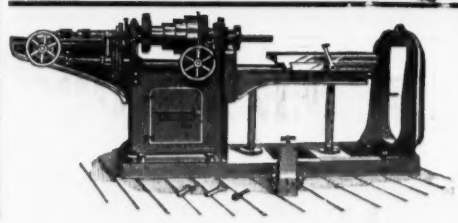

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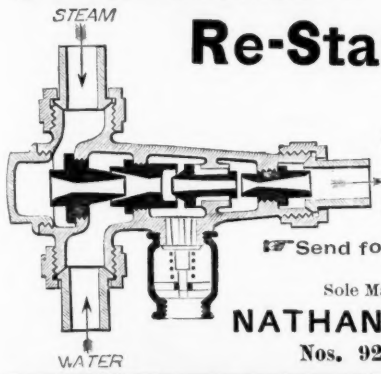

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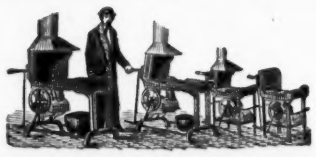

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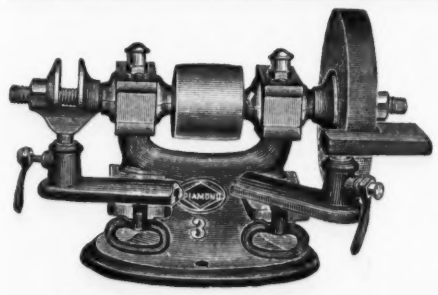

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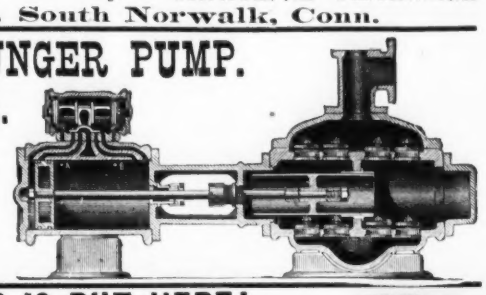

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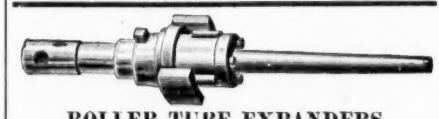

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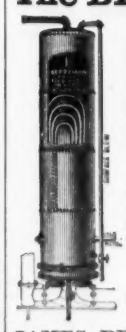

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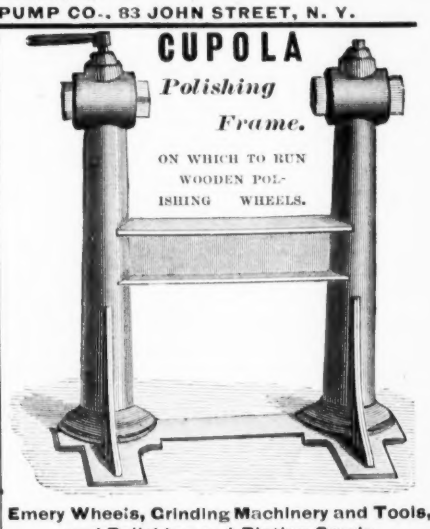

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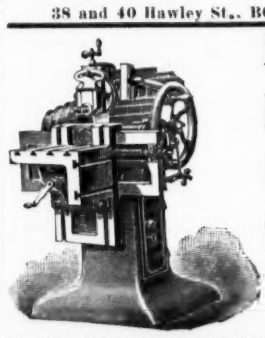

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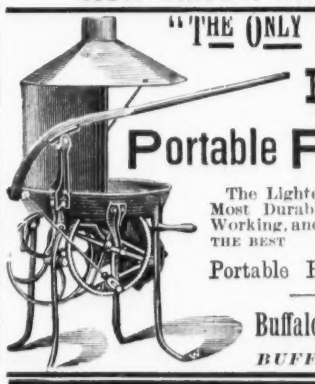

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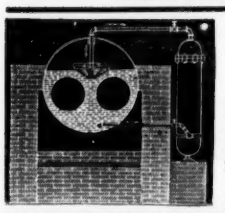

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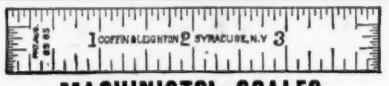

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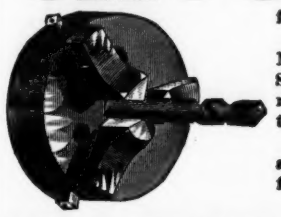

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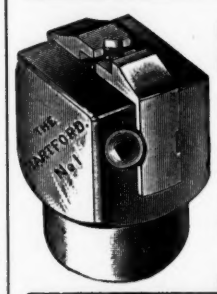

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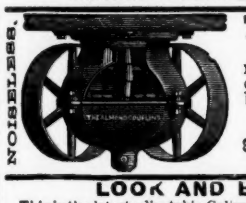

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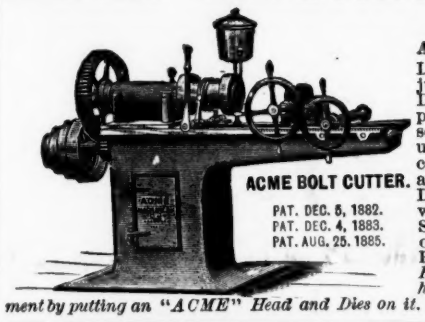

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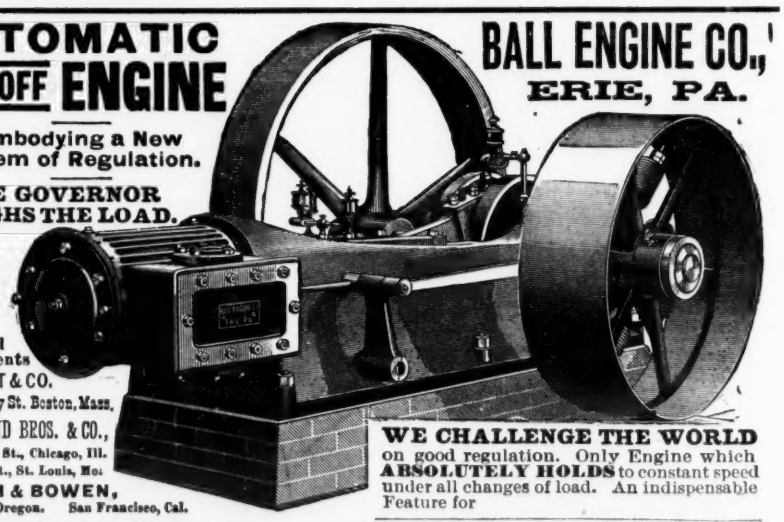

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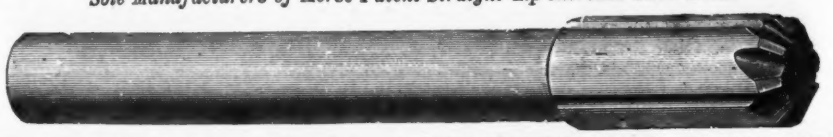

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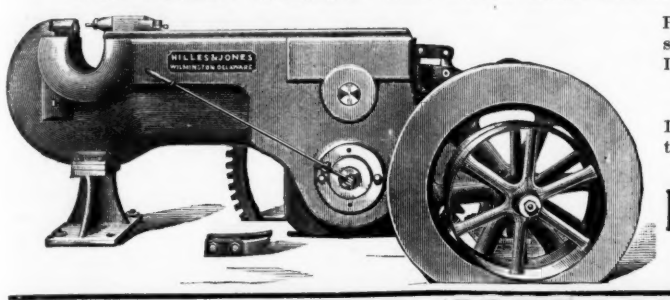

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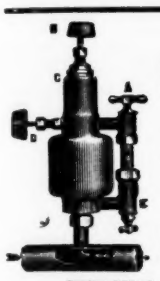

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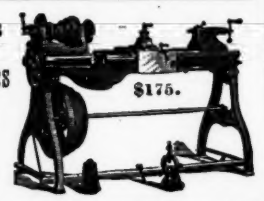

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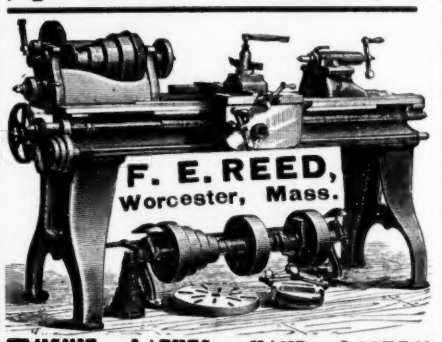

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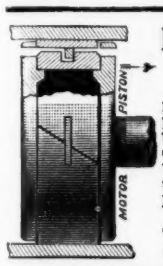

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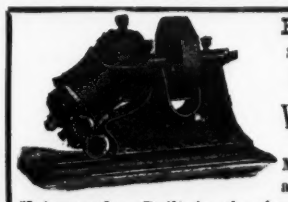

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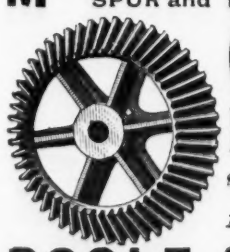

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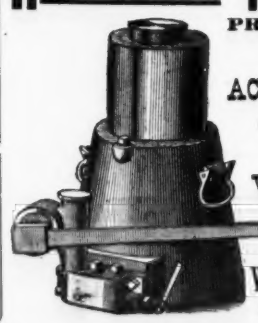

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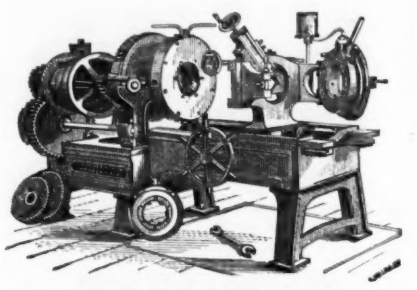

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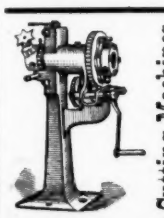

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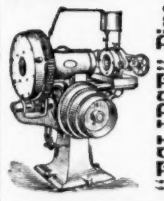

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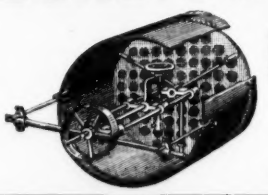

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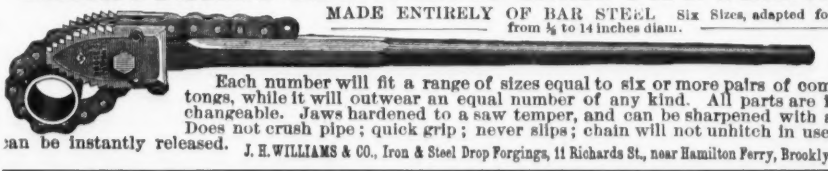

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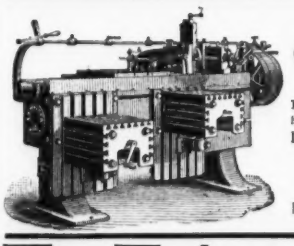

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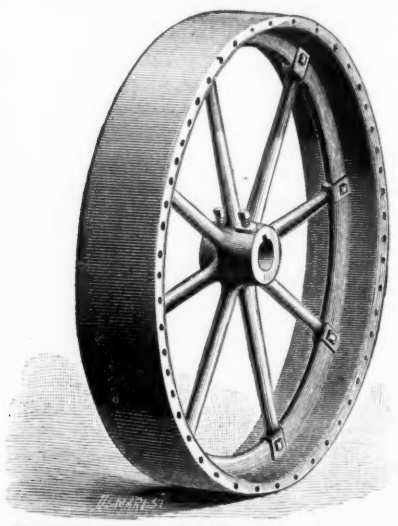

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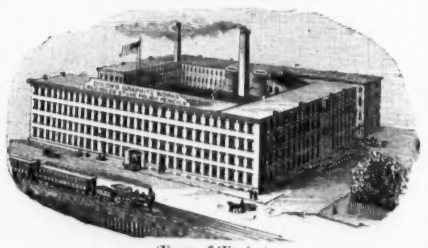

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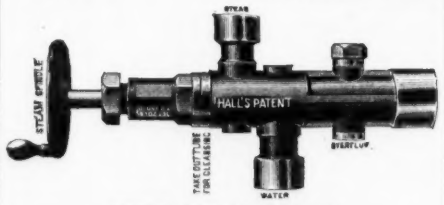

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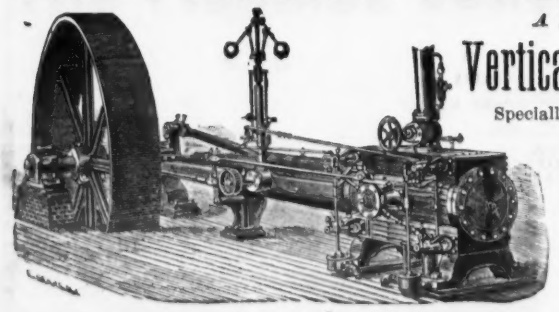

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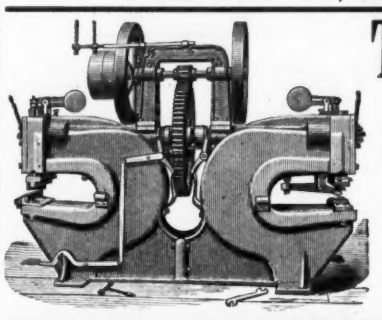

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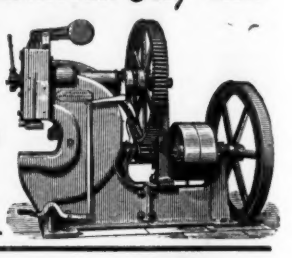

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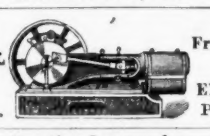

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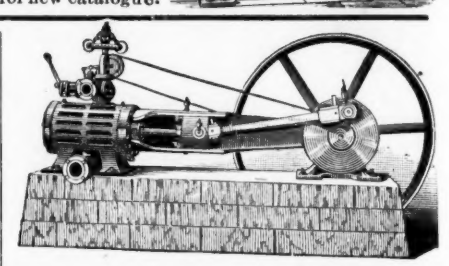

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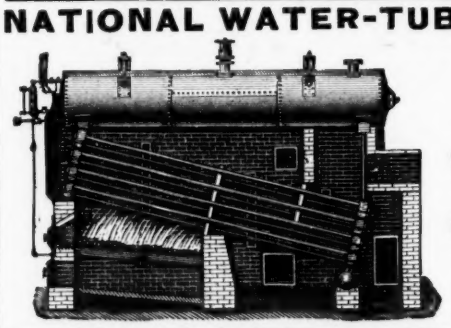

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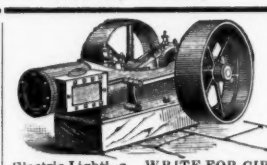

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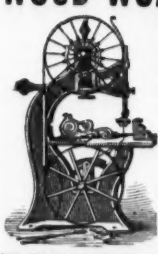

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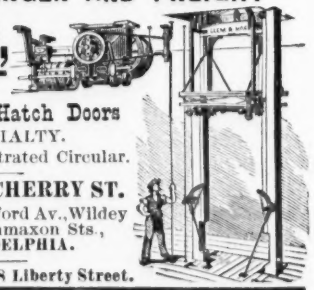

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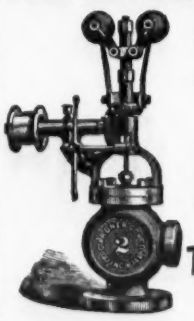

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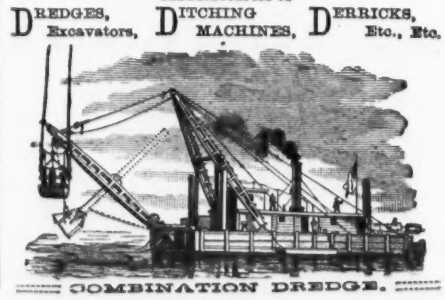

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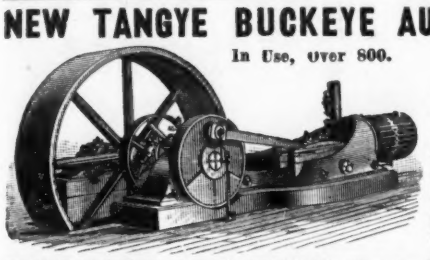

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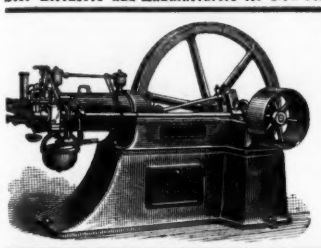

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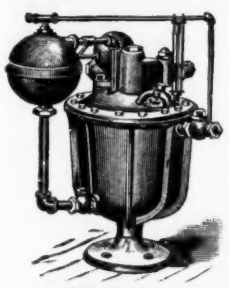

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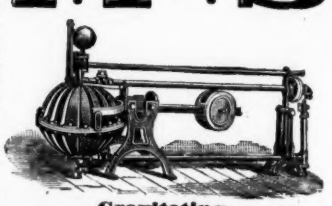

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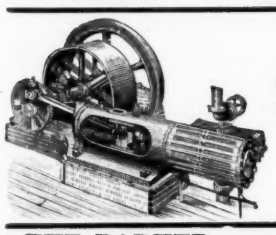

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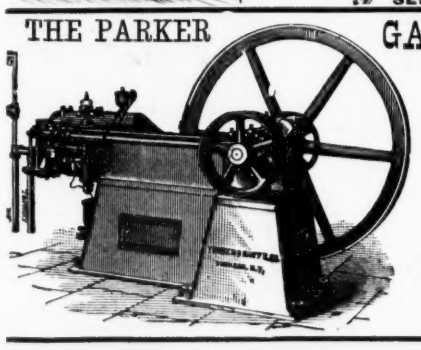

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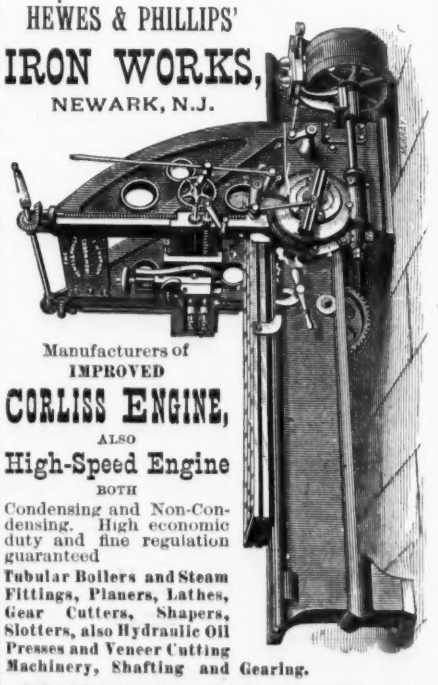

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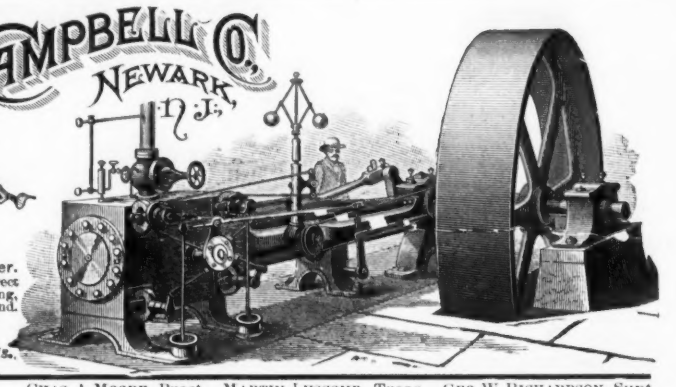

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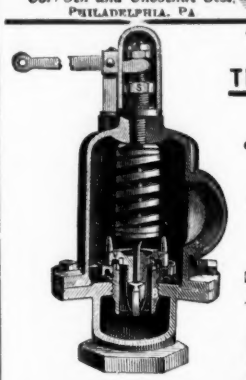

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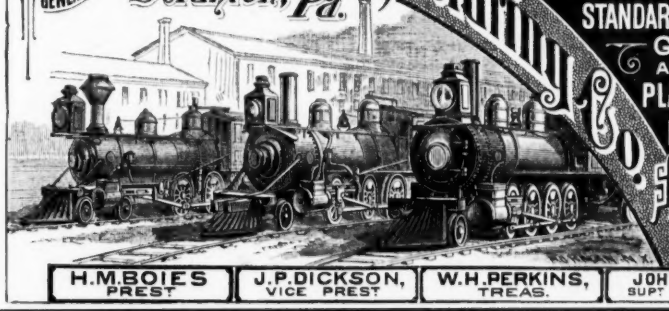

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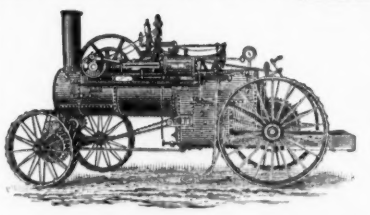

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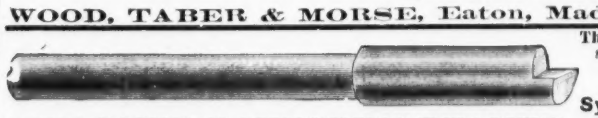

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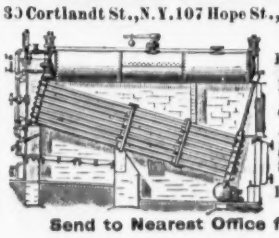

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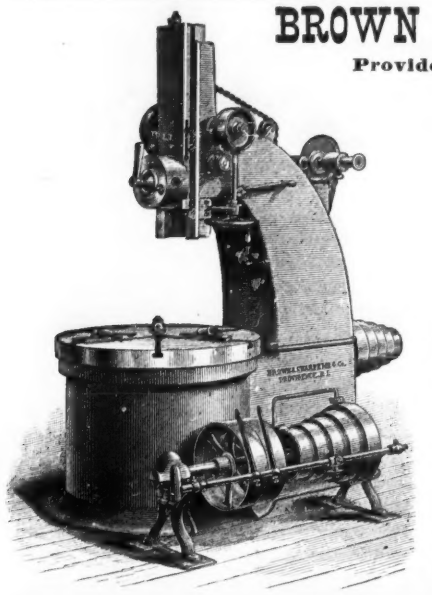

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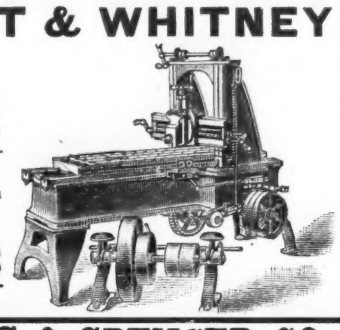

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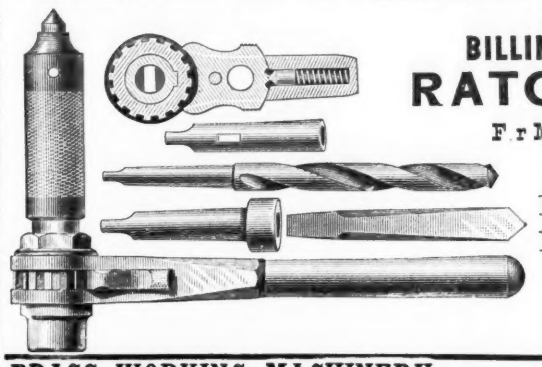

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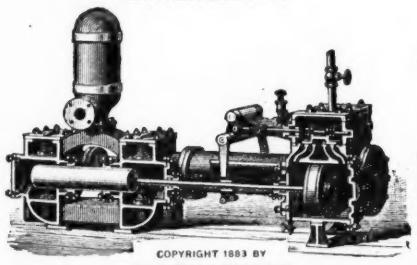

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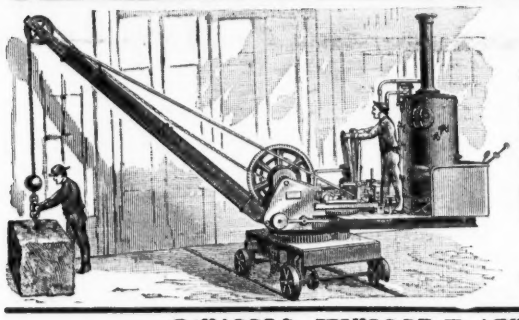

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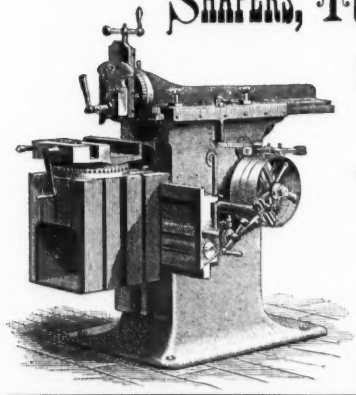

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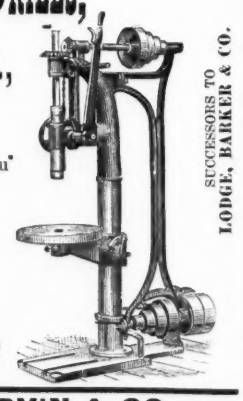

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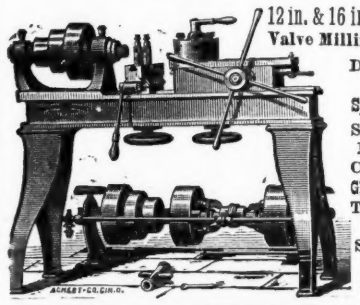

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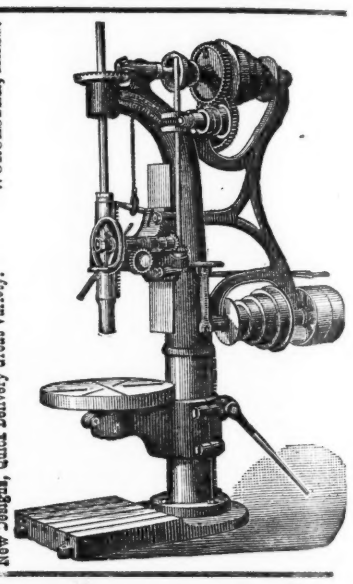

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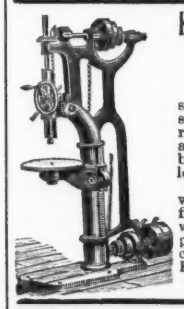

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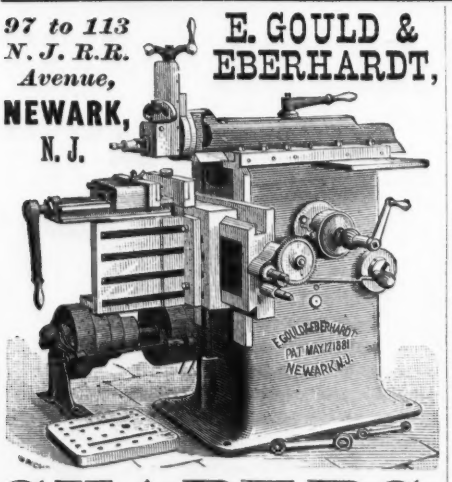

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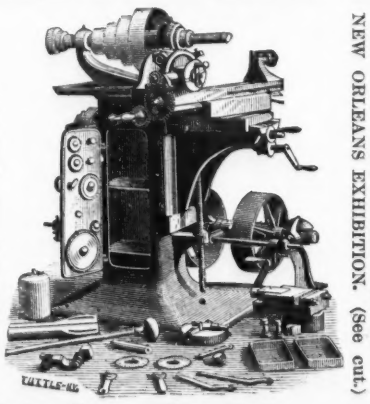

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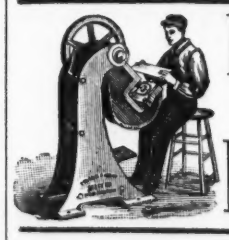

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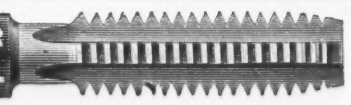

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